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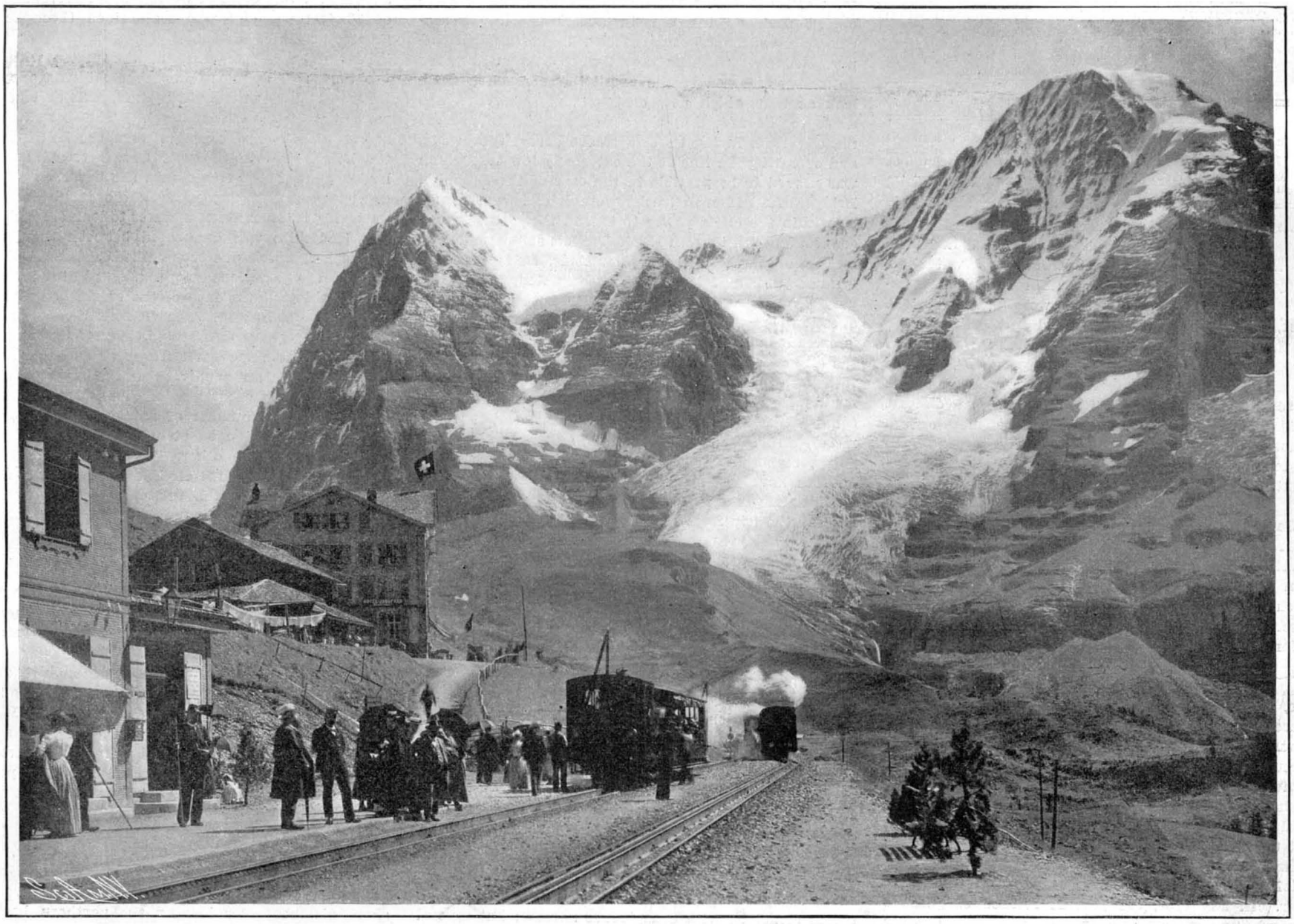
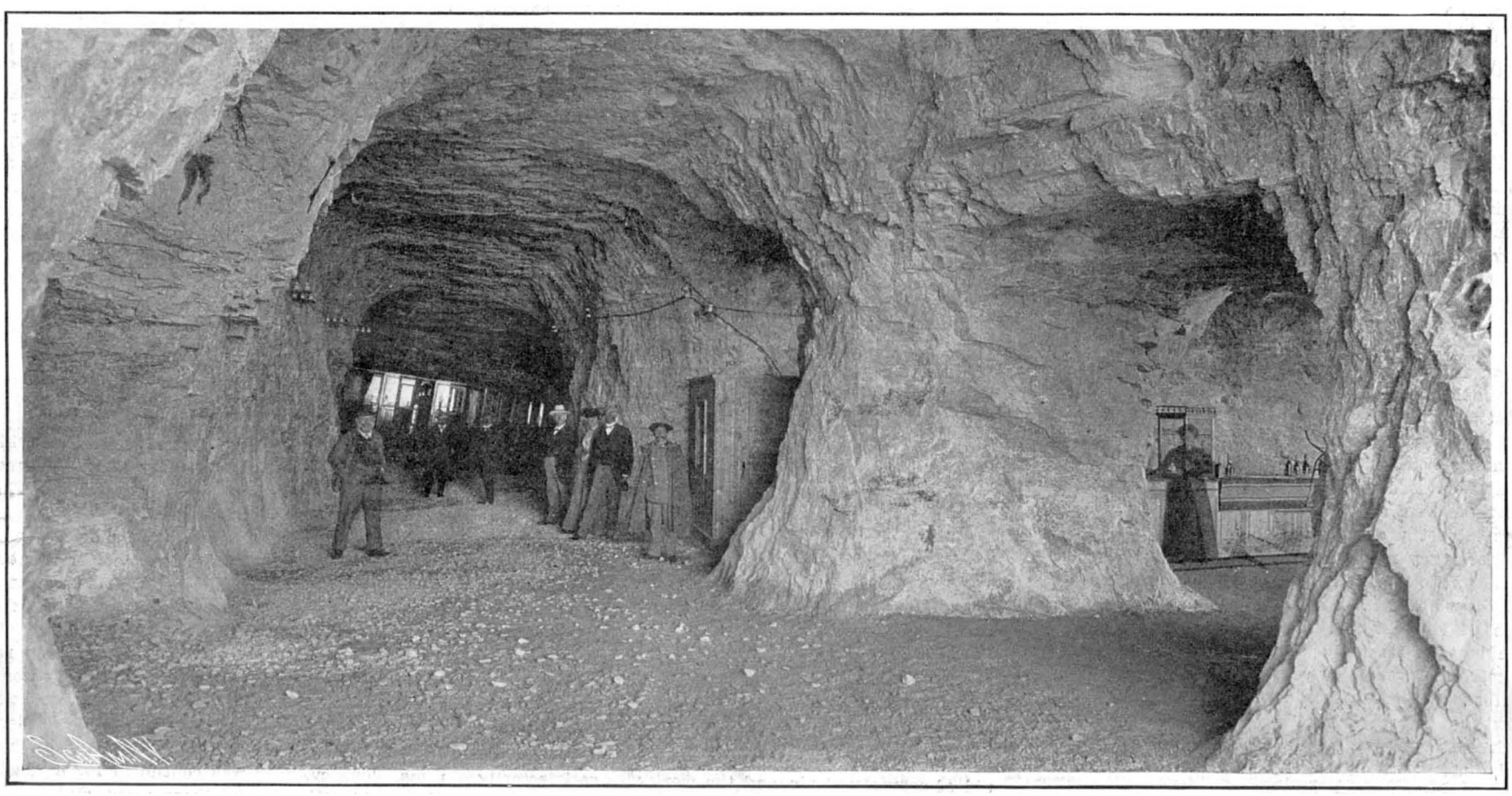


The Wengern Alp Station of the Jungfrau Railroad.



The Eigerwand Station, Blasted Out of the Solid Rock. Altitude 9,405 Feet. From the Tunnel a Gallery Leads, Whence a Fine View of the Alps is Obtained.

THE JUNGFRAU ELECTRIC RAILWAY.—[See page 369.]

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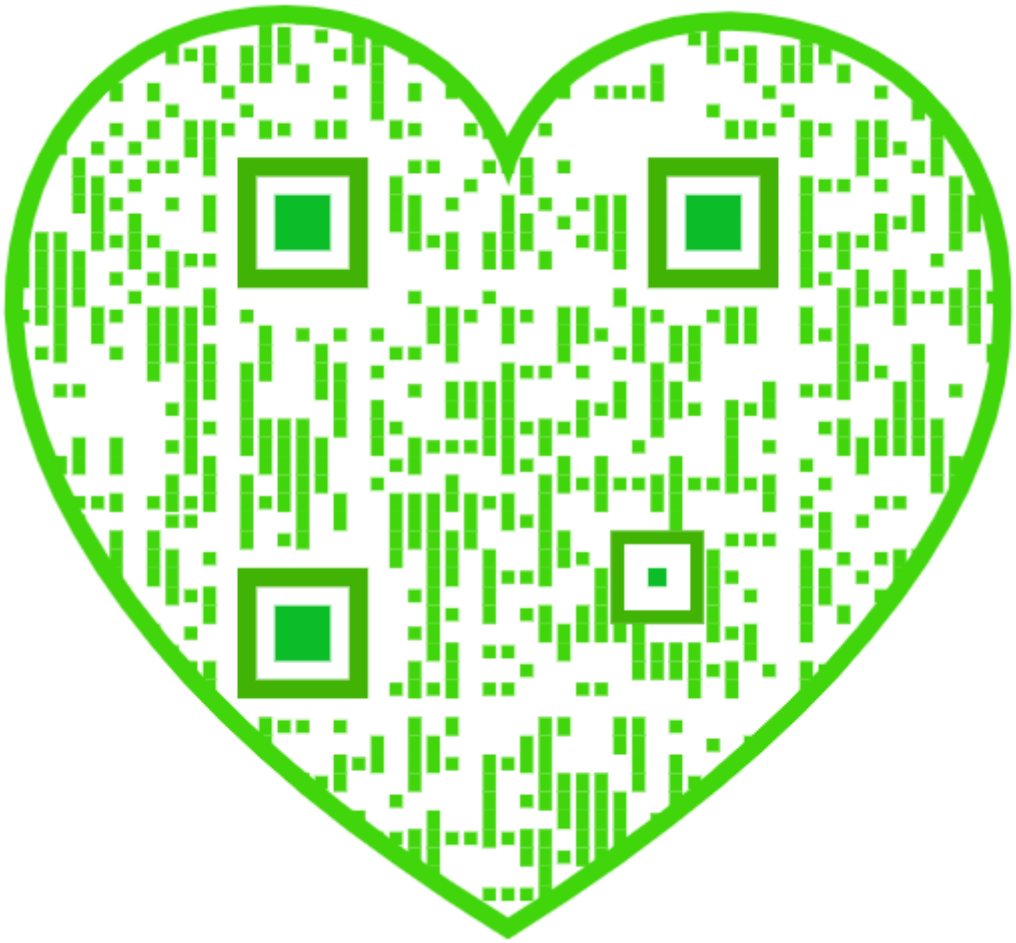

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NEW YORK, SATURDAY, NOVEMBER 21, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

GARBAGE DISPOSAL AND THE HARBOR CHANNELS.

The United States government is engaged in dredging a great 40-foot channel from deep water off Sandy Hook to the Narrows within New York Harbor. If a 40-foot contour line were drawn on the chart, it would be found to extend across the harbor mouth well inside of Sandy Hook lightship; and when the channel is completed, incoming vessels of the largest size will be able to sail from deep water to the Narrows without any of the tortuous and difficult navigation which at present is a source of more or less anxiety to incoming vessels, especially if they happen to be of the draft and length of our largest transatlantic liners. Unfortunately, the success of the scheme is menaced by the fact that the waters outside of Sandy Hook are used as a dumping ground for city refuse; and the enormous amount of refuse that is unloaded year by year from the city's scows would seem to be at last producing the disastrous results which have been feared by those who are interested in preserving unobstructed navigation into this harbor. A Sandy Hook pilot recently reported that in several places south-southwest and south-southeast from the lightship, and within a radius of three-fourths of a mile, the cast of the lead showed only 7½ fathoms where from 11½ to 16 fathoms are called for by the chart. Here is a matter that demands the immediate attention of the government. Seven and a half fathoms is within five feet of the depth to which the new channel is being dredged, and if this shoaling up is due to the dumping of city refuse it may be taken for granted that the formation of these shoals will be continuous. As matters now stand it looks as though we were undoing with one hand what we are doing with the other. In any case, the present method of garbage disposal is an extremely crude and provincial one for the metropolis of the western hemisphere. It is also distressingly "sloppy" and untidy. The neighboring shores of New Jersey give evidence of this, for they are adorned with a variegated fringe of domestic refuse and "cast-offs" that would do credit to the back alleys of a western mining camp.

THE WILLIAMSBURG BRIDGE FIASCO.

With the announcement by the Bridge Commissioner that the Williamsburg Bridge will be open for use by the first of December, the public is brought face to face with a fiasco which has been foreseen for many months by those who have watched the attitude of the trolley companies toward this great public work. It is a positive fact that when this great $20,000,000 thoroughfare is at last thrown open to the public, it will be practically useless, for want of transportation facilities to carry the people across it. It is a noble structure, its broad platform, one hundred and twenty feet wide, having provision for no less than six lines of railway; yet on the first of December, when it is officially declared open, there will not be a single elevated or trolley car ready to cross it, neither will there be a single yard of track laid upon it, nor the slightest prospect that any such tracks will be laid for many months to come.

The public of New York and Brooklyn, discouraged and disgusted with the crowded and indecent conditions of interborough travel across the river, have been longing for the opening of this bridge with an expectation begotten of very real and ever-present discomfort. For seven long years they have watched its growth, yet at the very hour when this great public work is at last pronounced at their service, it is found to be utterly useless as an immediate solution of transportation difficulties.

Thus do we add another chapter to the serial story of municipal mismanagement and civic discomfort.

The guilty parties in this matter are not far to seek. When the public is told that the administration solicited bids from the trolley companies for the privilege of using this $20,000,000 structure many months ago, and that no response whatever has been made, they will understand pretty clearly at whose door the responsibility for this fiasco is to be laid. If the press of the city is now openly charging that the trolley companies are holding back in the belief that the urgency of the situation will compel the administration to permit them to cross the bridge on their own terms, they have themselves to thank for the imputation. Whatever may have been the history of franchise-granting in the past, we cannot bring ourselves to believe that the transportation companies are so fatuous as to believe at this late day that they can lay hands upon enormously valuable franchises, such as the one in question, without rendering an adequate compensation to the city's treasury. A few months ago, when the SCIENTIFIC AMERICAN referred to the possibility of such a deadlock as that which now confronts us, reference was made to the fact that there was nothing to prevent the city from laying its own tracks across the bridge, and operating the line at the extremely low cost which was proved to be possible in the case of the Brooklyn Bridge. And if such tracks were laid, it would also be within the city's power to extend these tracks to a connection with its own Rapid Transit subways. Thereby it would rescue the Williamsburg Bridge from a tyranny which, if it is not contemplated, is at least very strongly suggested. There is not the slightest question that ultimately, as the Rapid Transit subway is extended, there will be a growing disposition to have the city construct, own, and operate its own system of transportation, and we believe that if the city government were to at once lay tracks across the bridge and connect them, as suggested, with the subway, it would merely anticipate a control which, as matters are now going, seems likely to be accomplished before many decades have passed. It is true that under the proposed arrangement double fares would be necessary in making the trip from New York to suburban Brooklyn or back; but judging from the present attitude of the trolley companies toward the bridge, the suburbanite will pay a double fare in any case.

IMPROVEMENTS IN TUNNEL-BORING PRACTICE IN LONDON FOR DEEP-LEVEL RAILROADS.

In view of the tunnel-boring operations that are now in progress through the bed of the Hudson River, and which we recently described in the SCIENTIFIC AMERICAN, a description of the methods employed in similar operations beneath the River Thames in England will be interesting.

There are at present several tunnels either completed or in course of construction beneath the River Thames, either for deep-level tube railroads or pedestrian communication between the opposite shores at the lower reaches of the river, where bridges cannot be constructed and a ferry system is not satisfactory. All of these tunnels have been bored upon the Greathead shield principle, with conspicuous success; but several precautionary measures have been adopted to insure to the men working in the borings absolute safety from the water pressure and other dangers, and several improvements, the results of previous experiences, have been effected in these boring operations and the erection of the tunnel.

There are two tunnels at present approaching completion beneath the bed of the river, one a footway tunnel connecting Greenwich on the southern shore with the Isle of Dogs on the northern bank, and a railroad tube forming a section of the Baker Street & Waterloo Tube Railroad.

The footway tunnel is 1,217 feet in length and is entered at either end from a shaft. In constructing this tunnel the contractors had to build it at such a level that it was possible to dredge a channel in the river 500 feet in width and 48 feet deep at high tide. This stipulation necessitated the tunnel shelving downward from either shaft to a point in the center of the waterway. This gradient is generally 1 in 15. The tunnel itself is of 12-feet 9-inch internal diameter, and is built up in the usual manner of cast-iron segments bolted together.

Boring was carried out from a caisson sunk on each bank. These caissons were composed of two skins of steel segments bolted together, the inner or smaller caisson having an internal diameter of 35 feet and the outer one an internal diameter of 43 feet. The 4 feet all-round space between the inner and outer walls was filled with Portland cement. The most distinctive feature of these caissons was the absence of any taper or batter on the outer wall. They were also provided with two airtight doors, one of a permanent nature, and the other only temporary, placed above the tunnel opening. These caissons were sunk into position by the aid of compressed air, and the work was satisfactorily accomplished without disturbing the surrounding ground.

The tunnel opening in each caisson, i. e., the entrance from the shaft to the tunnel below, was plugged up by steel plates between girders, preparatory to sinking. When the caisson was safely sunk this plug was removed. The latter was constructed in such a way that the steel plates of which it was constructed could be removed singly. As the plates were withdrawn a wooden diaphragm was constructed in their place 4 feet to the rear, and the space between this diaphragm and the face of the earth was filled with pugged clay.

The shield employed was of the "trap" or "box" type, and was 13 feet in external diameter. There were thirteen segments constituting the cutting edge, each segment being provided with two 6-inch teeth. Behind this cutting edge was a circular-built box girder. The method of boring was similar to that previously adopted for this class of work, and an average progress of 10 feet per day was maintained throughout the greater length of the tube.

In the bolting together of the plates with which the tunnel is lined, an improvement was adopted to insure better watertight joints. The bolt holes were provided with a bevel. The bolts were inserted with lead washers between the bolt heads and the holes. When the bolts were screwed home, the leaden washer was forced into the beveled space, thus completely filling and packing the joint tightly, and rendering it impossible for water to leak through. Also soft lead wire was hammered between the joints of each space, which was then calked.

Special precautions were adopted to insure the men working at the face of the shield being provided with pure atmosphere. The vitiated air was drawn off and pure, fresh air substituted. Experiments were also carried out to remove all traces of carbonic acid gas from the fresh air supply by cleansing it, previous to inhalation, with caustic soda. This cleansing apparatus comprised a number of rectangular wooden tubes superimposed, left open at one end and fitted with a sliding door at the other. The ends with the doors were connected with the air inlet of the tunnel through a conical box. In each tube were placed eight wire boxes filled with broken pumice stone which had been immersed in a caustic soda solution. These boxes were movable and could be withdrawn from the wooden tubes, which were also fitted with movable sides to enable the pumice stone to be removed, cleansed, and resaturated from time to time. The experiment was attended with success, for the percentage of carbonic acid gas in the pure atmosphere supplied to the workmen at the shield face was very appreciably reduced.

The boring of the tunnel beneath the Thames in conjunction with the Baker Street & Waterloo Railroad proved more difficult. Throughout the land sections of the track London clay had been encountered, but when the Thames bed was reached at the point of crossing, the clay stratum dipped abruptly, and the depression thus caused was filled with clean gravel and sand, and this was very water-bearing and treacherous. This necessitated boring under compressed air. There are two tunnels, for the down and up traffic respectively. They lie parallel and on the same level for a short distance after leaving the northern bank, but then there is a falling gradient of 1 in 107 in the case of the former, and an incline of 1 in 111 in the latter, toward the southern shore.

In this instance boring and construction was carried out from a temporary pile staging 370 feet in length by 50 feet wide, erected in the river 150 feet from the northern bank. From this staging two vertical shafts were sunk, each of 16 feet diameter, to the requisite level. The excavated earth, as it was removed from the boring, was conveyed to the top of these shafts and discharged straightway into lighters moored alongside, and subsequently transported down the river to be used for reclamation purposes.

Owing to the treacherous nature of the soil to be excavated, a hood was fitted in front of the tunneling shield to afford protection to the excavators while engaged at their task. There was also a fountain trap behind them which constituted an air seal against a horizontal water surface should the flooding of the tunnel appear imminent, through a sudden rush of water. There was furthermore a top screen forward of this trap. The latter was always close behind the miners, and it provided an easy and ready means of escape to the men in case of a water rush. This safety provision was found of great value and eminently successful for this purpose. The shield was divided into two complete halves in front of the fountain trap by a vertical girder. This enabled only a small part of the face of the soil to be excavated in either half should any accident befall the face planking. Another prominent feature of the shield, which was rendered imperative under the peculiar prevailing conditions, was a steel cylinder stiffened by a circular box girder behind the hood. At the rear of this cylinder was a strong ring of cast iron carrying fourteen hydraulic rams. The cylinder was continued for a considerable distance to the rear of these rams, and in the after section the tunnel rings were erected as the shield was moved forward.

When the tunneling beneath the river bed was first

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commenced there was a depth of 17 feet of solid clay out of a total cover of 34 feet. A solid 8-foot-thick diaphragm wall of brick and cement mortar was built across the tunnel with the working air lock and emergency lock through it together with all the requisite pipes. As the clay bed gradually decreased in thickness greater care had to be observed. When the clay cover to the shield had decreased to only 5 feet the box heading in front of the boring shield was abandoned and compressed air was brought into operation at a depth of 18 feet below the river bed. The shield was forced forward carefully until within about 3 inches of the gravel and sand soil or ballast, and then pockets of pugged clay were made and placed close to each other in advance of the cutting edge of the shield. This provided a soft bed for the cutting edge and shield to slide forward in. The quantity of pugged clay was increased in the ballast face all round the cutting edge; and as the shield then forced its way forward, the clay formed a thin blanket or lining right round the shield, and in the space left by the wall of the shield between the outer surface of the tunnel and this clay the grouting was forced. The clay also formed an effective air seal at the rear of the shield at the place where it covered the last erected ring of segments of the tunnel. The ballast face was timbered with horizontal planking packed closely together upon a thick bed or wall of the clay, and arranged by stretchers in two halves across the face, first held up against the shield, and later on held by up-and-down soldiers supported by round hollow steel struts passing through the shield when the latter was driven forward.

The tunnel was constructed in the usual way with cast-iron segments bolted together. Continuous longitudinal joints were made, dressed with a mixture of Stockholm tar and red lead before erection. Iron-rust cement was utilized for calking the joint grooves, which were grummeted where necessary. The grouting forced through holes bored through the tunnel rings to fill up the space occupied by the shield between the tunnel and the soil was composed of blue-lias cement.

Owing to the extreme care that had to be constantly exercised, boring through the sand and gravel was not sc rapid as it had been through the more solid clay, but an average daily progress of three rings of 18 inches diameter was maintained, which, under the circumstances, was very good. The air pressure maintained was precisely the same as the hydraulic head in the river, varying for the most part from 24 pounds to 32 pounds per square inch, according to the tides. Little inconvenience or sickness was experienced by the excavators while working under this increased atmospheric pressure. From 30,000 to 200,000 cubic feet of air at atmospheric pressure was pumped through the tunnel per hour, and the proportion of carbonic acid gas in the space in which the excavators were at work varied from 0.06 to 0.10 per cent.

THE WORKMAN EXPEDITION TO THE HIMALAYAS—AN ALTITUDE OF 23,394 FEET REACHED.

The expedition organized by Dr. William Hunter Workman to the Northwest Himalayas has returned after attaining a record altitude of 23,394 feet. The party comprised Dr. Workman, his wife, two guides, Mr. E. Hewett, of London, who accompanied them in the capacity of topographer, and a number of coolies. The expedition was highly successful, and the fruits of the work have added considerably to our present knowledge of glacier phenomena and topographical, geological, and scientific features of this extensive range of mountains.

By the middle of June the party had reached the Hoh Lumba glacier, which lies between the Hispar and Chogo Lungma glaciers. This glacier was traversed throughout its entire length. Near its middle point it is bifurcated by a sudden mountain projection, the two branches of the glacier being of similar sizes and lengths.

One branch, which appeared to be the main portion, rises in a snow *col* 18,600 feet high, crowned by a huge cornice projecting over a towering precipice of between 6,000 and 7,000 feet on the side toward the Hispar glacier. An inaccessible seracked icefall drops from this *col* to the Hoh Lumba glacier.

To gain this *col* was an extremely difficult task. Owing to the heat of the midday sun which melts the snow, avalanches are frequent during the afternoons. This fact rendered it necessary that the ascent should be made in the early morning.

The party started at daybreak to essay the laborious task. First there was an immense bergschund which had to be negotiated, and the climb was over a succession of ice slopes rising at angles of 60 deg. and covering the shoulder of a mountain above a high precipice. The climb was successfully accomplished in five and a half hours, the party attaining the crowning cornice by 10:30 A. M. As further progress was rendered impossible by the precipice, the members of the party secured a series of photographs and other data and then descended.

The second branch of this glacier, which is called the Sas Bon, terminates in a similar *col* and cornice of approximately the same height, also with a precipice toward the Hispar glacier. Some sharp slopes in this case also had to be climbed in order to reach the top, the party often wading waist-deep through the soft snow. As a matter of fact, the snow was the only serious difficulty with which the expedition had to contend. This abundance was due to the abnormal falls that had accompanied the violent and numerous storms of last winter, and also those of June and July. Even the camps had to be pitched in deep soft snow on the glacier.

The expedition made another ascent of the Chogo Lungma in July, and established themselves at the same camp which had constituted their headquarters in 1902. This camp was built on a rock promontory some 14,000 feet above sea level. The violent weather considerably handicapped the explorations of the party, since there were only two or three days during the month when snow did not fall. The party proceeded along the upper southwestern branch of the Chogo Lungma, which lies at a high elevation completely covered with snow, and swept on both sides by avalanches. After completing this task they directed their efforts to the investigation of the three snow peaks which encompass the glacier, and which tower from 17,000 to 20,000 feet in height.

In order to carry out this part of the work, three light camps were made. The first was situated on a smaller glacier at the base of the snow slopes which rise toward the first peak at an elevation of 16,200 feet, the second on a small snow plateau at 18,600 feet above the lower slopes, and a third was at a height of 19,355 feet at the foot of the third peak. It was found impossible to establish a higher camp, because the coolies attending the party became afflicted with *sorochté*, or mountain sickness. They could not be persuaded to climb any more; and perforcedly the last climbs had to be carried out from this camp.

Dr. Workman, in company with his wife and the guides, set out at 3 o'clock in the morning. The thermometer stood at 15 deg. Fahr., and they had to wind their way up steep snow slopes, which at places were of a zigzag nature, and inclined at upward of 70 deg. It was a very laborious climb, but at 7 o'clock they gained the summit of the first peak, which is a curling cornice. The temperature was 16 deg. Fahr. and the height 21,770 feet. A short stay was made here to enable barometric, hypsometric, and thermometric surveys to be carried out. These readings accomplished, they continued their way toward the summit of the second peak, which was connected to the first one by a snow *arete*. At 10 o'clock the party stood on the summit of the second peak at an altitude of 22,567 feet.

There only remained the third peak to climb, which, if the Indian Trigonometrical Survey is to be believed, is 24,486 feet in height. This is joined to the second peak by a rising snow plateau. As the party was somewhat fatigued by their climb of seven arduous hours, all hope of reaching the summit of the third peak that day was abandoned. Furthermore, it was recognized that if the summit were ever to be gained, it would be necessary to pitch a camp upon the snow plateau, which was at an altitude of 22,000 feet. The difficulties of this proceeding, however, were soon apparent. The coolies, owing to their affliction with mountain sickness, would on no pretense ascend to a greater altitude, while it was additionally dangerous owing to the unpropitious weather which was prevalent.

Dr. Workman, however, observed that there was a point about 1,000 feet higher on the southwestern *arete* which afforded a finer view of the valleys toward Hunza; and as Mrs. Workman was somewhat tired with her already tedious climb, he set off himself with the two guides. The climb was a sharp one up steep snow slopes, but the *arete* was gained at 12:30 P. M. At this point a series of calculations founded on the barometer and hypsometer readings taken here, together with those secured at the same hour of the mercurial government barometer at Skardo, showed that the altitude attained was 23,394 feet, some 300 feet higher than the summit of Aconcagua. This remarkable achievement of Dr. Workman creates a new record in mountain climbing, as the record has hitherto been held by those who had gained the summit of Mt. Aconcagua. It may be mentioned also that on this same day, in connection with this identical climb, Mrs. Bullock Workman, who is an expert mountain climber, broke her own and all other women's records. Hitherto her highest ascent had been that of the Kaser Gunge, 21,000 feet, which had been excelled on this date by the climbing of these two peaks by 770 feet and 1,567 feet respectively.

It was a momentous accomplishment, and one that had been accompanied by considerable danger and hard work, as the whole of the ascent had been carried out on ice and snow, which in some places proved exceedingly dangerous.

After returning to the lower level once more, the expedition next directed its steps toward the exploration of the Balucho Glacier, which is a large branch of the Chogo Lungma. During this part of the work a snow pass was discovered at a height of 17,000 feet which led to the Kero Lungma. A cornice on the brow of this pass was cut away to allow of the passage of the caravan of the expedition, which was led down a steep avalanche-gullied snow wall falling away for 1,000 feet to the glacier below. This task occupied four hours. They next followed the Alchori glacier, which is the largest branch of the Kero Lungma, continuing their journey right up to its source. It terminated at the head in a steep rock of a snow *col* 18,200 feet, and this was ascended by Mrs. Bullock Workman and her guides. This *col* overlooks the Hispar glacier, to which it falls away precipitously for several thousand feet. With the exception of the Nushik La, the party found no possible passage to Hunza in this region.

Throughout the whole of the expedition, hypsometer, barometer, and thermometer readings were constantly taken, together with readings of the sun temperature, by means of the black bulb thermometer. At Skardo also, temperatures and readings of the government mercurial barometer were taken three times every day, by the official stationed there, for the purpose of calculating the heights. Numerous interesting and striking photographs were also taken, and several surveys made in connection with the phenomena of the movement of glaciers, to our knowledge concerning which Dr. Workman will contribute considerable valuable data as a result of his daring enterprise.

SCIENCE NOTES.

The University of Chicago has received valuable concessions from the Sultan of Turkey in connection with the exploration of the neighborhood of ancient Babylon.

Chauveaud calls attention to the presence of laticiferous tubes, some simple, others branched, in the liber of conifers, while the resinous fluids are poured out of the cells in which they are formed, with intercellular resin-canals; the latex remains within the cells. The laticiferous tubes are specially seen in the young seedling plants.—Comp. Rend.

Dr. Frank Irving, chief of the X-ray department of the Newark City Hospital, has exploded the story alleged to have been circulated by a local physician to the effect that the X-ray would slaughter mosquitoes and other insects, and as a result of which Dr. Irving has received a number of letters asking for information.

A new apparatus, of French origin, is based upon the evaporation of formic aldehyde. The solution of formic aldehyde is boiled in a vessel heated by a spirit or other lamp, the escaping vapors being led through a tube made flexible, so that it can be passed through the keyhole of the door of the room to be disinfected. A gage shows the level of the liquid, and scales are provided to show the amount of liquid to be evaporated to disinfect the room properly.

Prof. Munsterberg's mission to Germany to secure the attendance of German scholars for the congress in connection with the St. Louis Exposition has been most successful. Two-thirds of all those invited have accepted. The attendance of scholars from Germany will be larger than from either France or Great Britain. The German government is heartily co-operating in the efforts to secure a good attendance from that country, and Emperor William has expressed the keenest interest in the congress.

It has been maintained repeatedly by G. Bertrand that arsenic, like carbon, sulphur, and phosphorus, is a constant constituent of the organism. He now finds (Annales de l'Institut Pasteur) that all parts of the hen's egg contain appreciable quantities of arsenic, the yolk containing the greater part. In the 1-200 of a milligramme found in one egg, from one-half to two-thirds is found in the yolk. The enveloping membrane contains almost as much arsenic as the white. These observations confirm the supposition as to the existence and the probable rôle of arsenic in all living cells.

An Italian has invented a saturation hygrometer which may be used for determining the tension of aqueous vapor in the air in small spaces, such as instrument cases. A portion of the air to be examined is withdrawn and saturated with aqueous vapor, and the increase of pressure thus caused is noted. Knowing the saturation vapor pressure, it is possible to deduce the aqueous vapor pressure of the experimental air. The apparatus consists of a bronze receiver fitted with a thermometer. Into the receiver passes a glass tube drawn out at the lower end, and connected at the upper end with a spring which serves to force in drops of water. The receiver may be put in communication with the exterior air, and carries at the side a graduated tube of 3.2 millimeters diameter, containing a column of petroleum 2.5 centimeters long.

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ARTIFICIAL CAMPHOR.

BY A. FREDERICK COLLINS.

Within twenty-five miles of New York city, at Port Chester, a plant has been erected, the science of chemistry is doing its work, and a natural product of worldwide utility but of heretofore limited and distant supply is being manufactured on a commercial scale. The substance obtained by the process here in operation is camphor—true camphor artificially produced. The distant and uncertain supply of camphor, the gradual destruction of its trees, the length of time required to grow new ones, and lastly the camphor monopoly, have stimulated chemists to devise a process of manufacturing camphor synthetically; by this it is meant that they have striven for the chemical extraction of certain principles from some of the essential oils, which treated and combined with other chemicals would result in the product sought.

After many months of laborious research by a corps of expert chemists, a principle was discovered and a process developed by the Ampere Electro-chemical Company, which gave promise of commercial success. The discovery was made during the course of some experiments in the synthetic formation of one of the essential oils, when in the product obtained a slight odor of camphor was detected. This hint was followed by the most painstaking and persistent care, but month after month went by before any actual camphor was obtained, and then the yield did not amount to more than two per cent of the material used. Though the results were at first meager indeed, by continued investigation, however, a yield of twenty-seven per cent of the raw material was finally obtained, but it required nearly two years to accomplish this result.

Generally speaking, all of the essential oils and allied compounds belong to the terpene family; that is, they are hydrocarbons. The discovery made at the Port Chester plant was that by introducing the carboxyl group into turpentine, two new compounds resulted, both of which were readily converted into camphor. The possibility of this transmutation is the more readily seen when it is remembered that turpentine, derived so abundantly from the pine trees of our own southern forests, is, chemically considered, $C_{10}H_{18}$, whereas camphor, derived directly from the camphor tree of far-away Formosa, is $C_{10}H_{16}O$; that is, the only chemical difference between turpentine and camphor is one atom of oxygen. Turpentine is derived from the pine tree very much as sap is obtained from the maple. It is in fact pine sap distilled and purified. In this state it is found to consist of ten atoms of carbon united with sixteen atoms of hydrogen, and the distilled juice of the pine tree and the distillate from the wood of the camphor tree differ only by the addition of one atom of oxygen to the latter.

By introducing a carboxyl into pinine, which is the essential and main constituent of the American and French oil of turpentine, two new compounds are formed, namely, pinyl oxylate and pinyl formate, and both of these can by simple chemical means be converted into camphor. The oxalate yields camphor by distillation with steam in the presence of an alkali; the formate under the same treatment yields borneol camphor, which is a hydrate of the product sought for, and by simple oxidation yields camphor.

The borneol camphor, aside from being easily converted into pure camphor, is a constituent of many natural essential oils and perfumes. It occurs in small quantities in nature, and is quoted in the open market at about ten dollars per pound. After nearly two years of experimental research in the laboratory, the process gave such promise of practical results that it was decided to construct and operate a small commercial plant, and this was carried out at the Ampere company's development station at Niagara Falls. A small equipment capable of producing in the neighborhood of one hundred pounds of camphor a day was constructed and operated for almost a year, and from the data thus obtained the present manufacturing plant was designed, built, and operated.

In the steam-jacketed reaction tanks, shown in Fig. 1, oil of turpentine weighing at least two thousand pounds is placed, together with anhydrous oxalic acid, the result of this reaction being pinyl oxalate and pinyl formate. After the completion of this step in the process, the mass, which is liquid, is pumped into a set of stills for treatment. Here it is distilled with live steam in the presence of an alkali, the resultant formation occurring as ordinary camphor and borneol camphor dissolved in the oily products of the reaction. These oils are fractionally distilled to extract the camphor and borneol further. After the pleasant-smelling oils have passed over, the camphor and borneol distill in the steam and are precipitated in the condenser in a white mass somewhat resembling boiled rice. The crude product is then forced by compressed air through a filter press, and thoroughly washed to free it from all traces of oil, when it is dropped into an oxidizing tank, where the borneal oxidizes into ordinary camphor.

The mass is again transferred to a rapidly-revolving centrifugal machine, where the oxidizing liquors are thrown out, and the camphor, being heavier, remains behind, comparatively pure, but stained from the oxidizing compound, so that it resembles light-brown sugar. After removal from the separator it is placed in a large steam-jacketed sublimer. In this vessel a slow heat frees it from any water it may contain, and the temperature is then raised to the boiling point of camphor, and a rapid current of air projected over the surface of the pan, blowing the camphor into a condensing chamber, where it settles in the form of snowflake-like crystals.

The subliming pan and its condensing chamber are so arranged that from the time the crude camphor is put in to the time it comes out, human hands do not touch it, but it is transferred mechanically into paper-lined barrels, thus insuring absolute freedom from dust or any extraneous matter or impurities. The yield of camphor by this process is from twenty-five to thirty per cent of the weight of turpentine used. In addition to camphor, there are a number of light oils produced in the process, which are also found in nature, namely, dipentine, oil of lemon, oil of lime, and a number of other natural terpenes and essential oils. The process of synthetically producing camphor takes about fifteen hours. This is the occidental way of doing things.

The Formosa monopoly dates from August 5, 1899, and at that time refined camphor sold in the open market in the city of New York at 43½ cents per pound. In March, 1900, the Japanese government arranged with a London firm for the distribution and sale of the entire camphor production of Formosa. Since the formation of the imperial monopoly the price of camphor has steadily advanced from 43½ cents to 51 cents per pound to December, 1899.

Since the letting of the contract, the price has fluctuated between 55½ and 60½ cents per pound, these quotations being for lots of three hundred pounds and upward. The government pays the natives 12 cents per pound for the standard crude article; and in getting the camphor ready for the market, the government is put to an additional expense of about nine cents per pound. It turns this product over to its London agents or to consumers in Japan at 32 cents per pound for grade B and 35.7 cents for grade A. Considering loss in refining and cost of delivery to jobbers and wholesale houses, plus profits of refiners and middlemen, the price of refined camphor to the consumer is from 55 to 60 cents per pound.

It is not generally known that only about one-fourth of the total amount of camphor consumed in this country is used in medicine; the remaining three-fourths is consumed in the arts, being largely employed in the manufacture of artificial leather, in celluloid, in gun-cotton, in photo-films, etc. Artificially produced camphor, or synthetic camphor, for it is in no sense artificial nor different from the natural wood product, promises to reduce the price of this important drug at least to some extent, and to be a wholesome competitor of the Japanese monopoly in the markets of the world.

In the current issue of the SUPPLEMENT will be found an exhaustive article on the natural camphor industry, in which the industrial features of this monopoly are discussed.

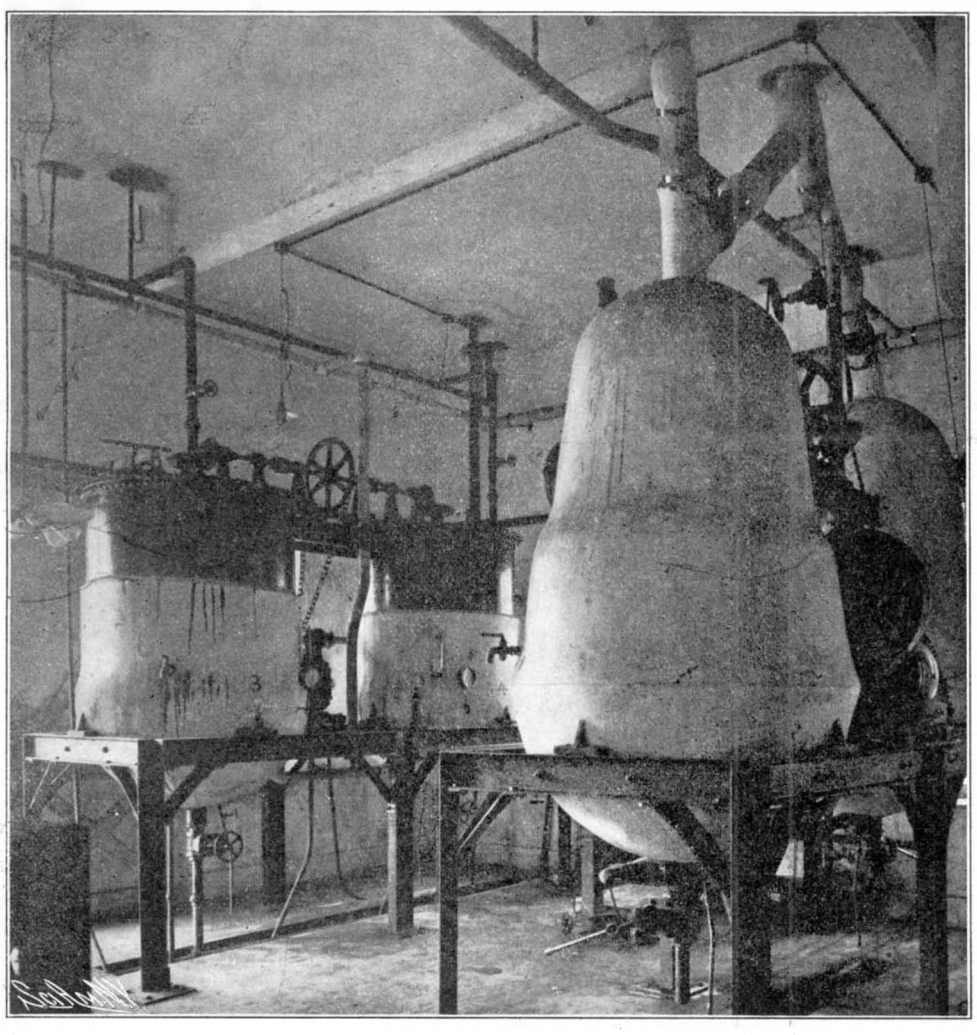

Fig. 1.—ARTIFICIAL CAMPHOR PLANT. TWO SETS OF REACTION TANKS AND STILLS.

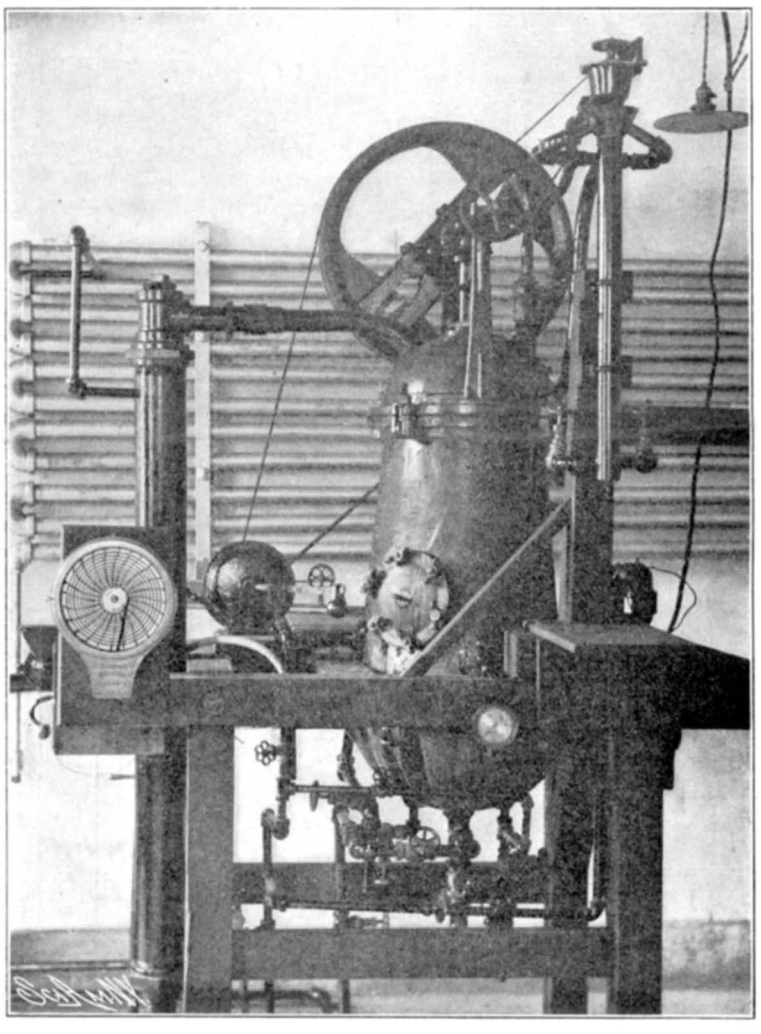

Fig. 2.—COMBINED REACTION TANK, STILL, AND CONDENSER FOR PRODUCTION OF CAMPHOR IN THE LABORATORY.

The Largest Meteor.

The Smithsonian Institution's expert, F. W. Crosby, examined the meteor which fell at Lodi, Cal., and pronounces it not only genuine, but the largest ever found in the United States. It weighs between 10 and 20 tons. From all appearances it seems to have been buried in the hill, where it was found, for many years,

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THE JUNGFRAU RAILWAY.

BY THE LONDON CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A few weeks ago the new Eigerwand station on the electric railway which is being constructed to the summit of the Jungfrau (13,670 feet) was opened for traffic.

At the present moment four stations are open, and it is expected that the next—the Eismeer (10,355 feet)—will be opened before very long.

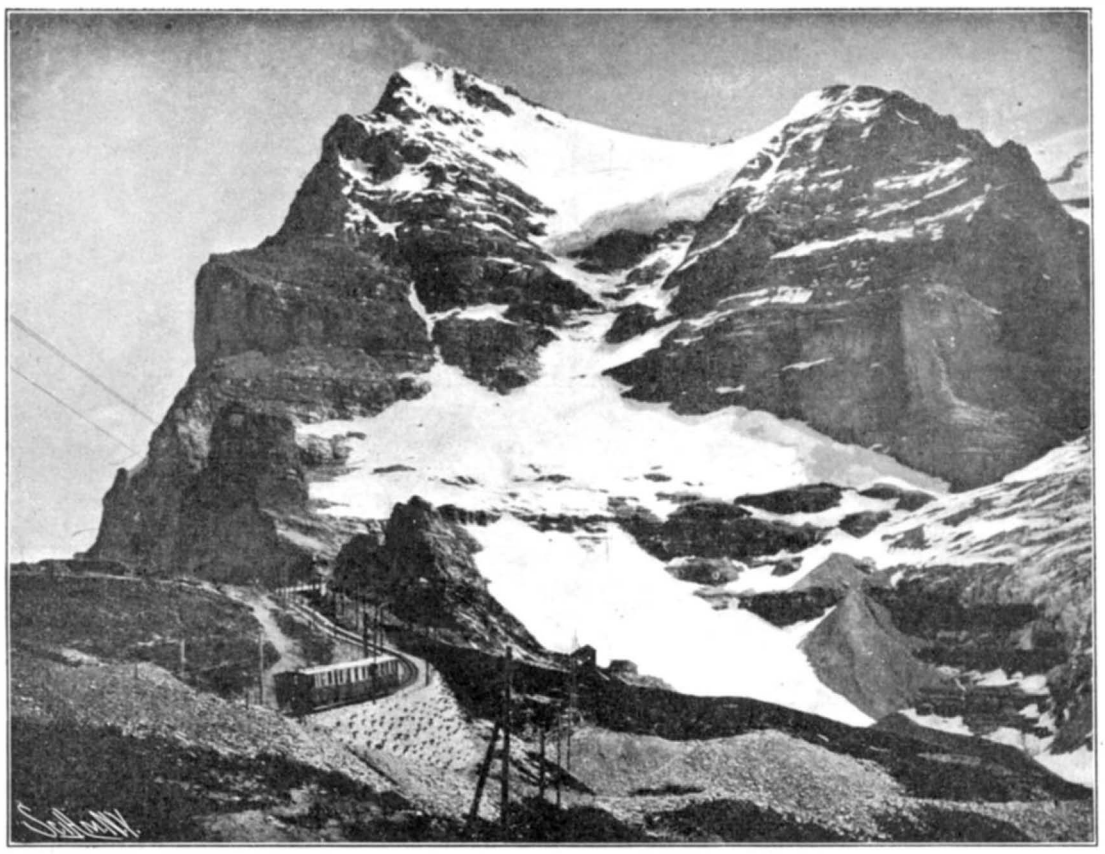
The line starts from the Scheidegg station (6,772 feet)—the highest point on the Wengern Alp rack-and-pinion steam railway, which runs between Lauterbrunnen and Grindelwald. One of our photographs shows the Wengern Alp station on this line (6,160 feet). Trains are made up of one car and one engine only, and the rack-and-pinion system used is that of Riggenbach.

From the Scheidegg to the first station, Eiger Glacier (7,645 feet), the line is in the open, with the exception of a short tunnel 92 yards long. From this point a splendid circular view is obtained.

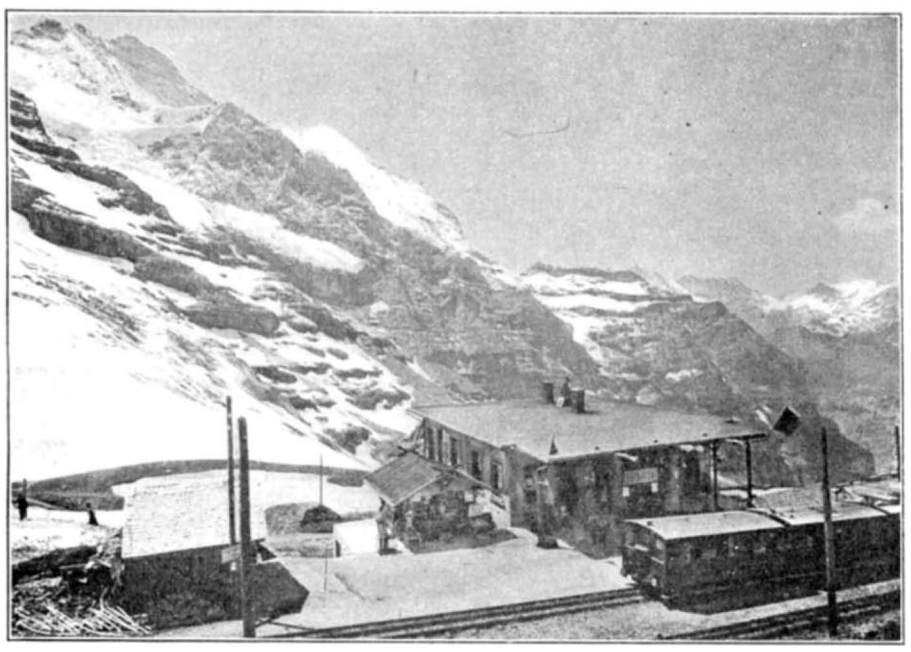
"To the south the northern slopes of the giants of the Oberland—the Eiger (13,040 feet), Mönch (13,465), and Jungfrau—with their glaciers stretching down along the rocky walls; to the west the snowy summit of the Blümlisalp, Breithorn, and Tschingelhorn; to the north the Lauberhorn, Tschuggeu, Männlichen, Faulhorn, and the Schwarzhorn; and to the east the great Scheidegg, the Titlis, Mettenberg, and the Wetterhorn."

The Eiger Glacier station is 1¼ miles from the starting point and the train has mounted 259 meters.

After skirting the face of the cliff the train enters the great tunnel, and for all the rest of the way it is underground. Galleries will be cut at each station (similar to those of the Ascensitpasse on the Lake of Lucerne) to allow passengers to obtain views of the magnificent scen-

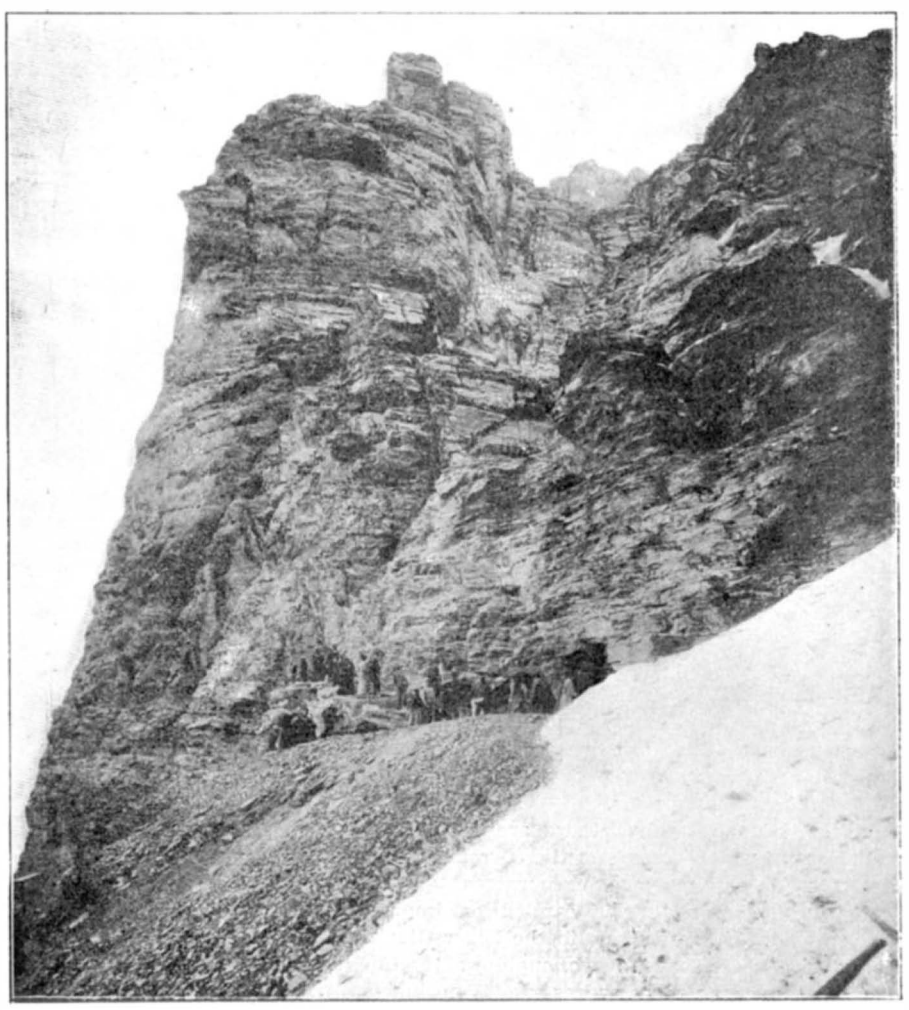


The Eiger Where it is Passed by the Jungfrau Road.

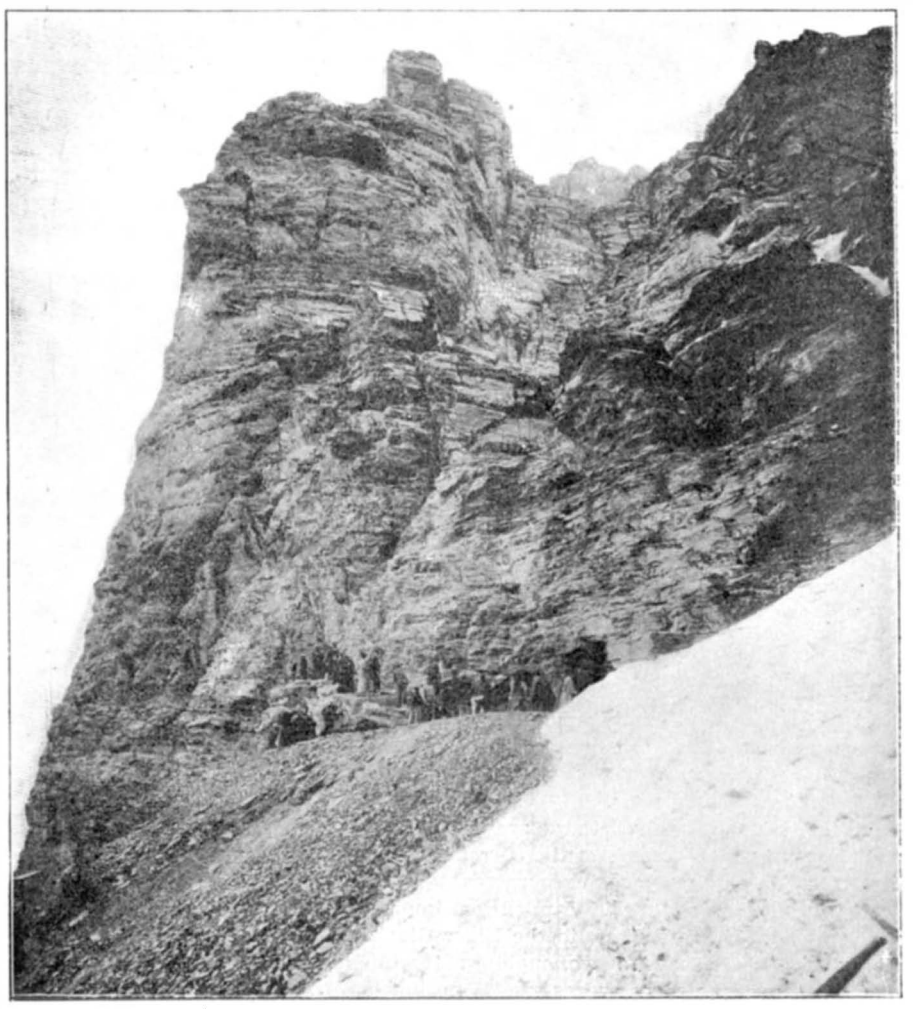


Eigergletscher Station. Altitude 7,645 Feet. The Jungfrau in the Background.

The Rothstock Station (Located Back of the Star). Altitude 8,270 Feet. The Dotted Line Shows the Course of the Road Through the Rock.



A Steep Grade on the Jungfrau Railway. The Silberhorn in the Background.



The Rothstock Station-Tunnel. Altitude 8,270 Feet. A Gallery Has Been Blasted Out of the Rock in Order that the Passengers May View the Landscape.

THE JUNGFRAU RAILWAY.

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ery. The Jungfrau tunnel will be 10 kilometers in length.

THE TUNNEL.

The tunnel is 3.70 meters wide and 4.35 meters high.

Electric boring machines are used. The number of shocks amounts to 380 a minute, the force employed being about 5 horse power per machine. Each weighs about 75 kilogrammes and they are worked by Thomson-Houston motors.

Nobel's nitro-glycerine is the explosive used; this has to be constantly thawed, as temperatures from 10 deg. to 27 deg. C. below zero are encountered.

The second station is the Rothstock (8,270 feet), 2 miles from the starting point. A transverse shaft, or gallery, 25 feet long, leads to a platform, open to daylight, projecting from the vertical side of the Eiger; one can ascend the Rothstock 8,753 feet and attain a fine view over the Lauberhorn to the lakes of the Swiss plateau and to the far-off mountain chains of the Jura, the Vosges, and the Black Forest.

The third station, lately opened, is the Eigerwand (9,405 feet).

This (and the same arrangement will be adopted in all the following stations) is constructed out of the rock; it consists of a large excavation; the walls, vault, and floor have a wood lining. There is a restaurant, waiting room, bedrooms for tourists, apartments for the officials, etc. All the rooms are lighted and heated by electricity.

As at the Rothstock station, a gallery has been cut to allow of views of the mountain ranges.

Beyond the Eigerwand station the tunnel, now in course of construction, takes a curve to the next station, Eismeer (sea of ice) (10,355 feet), to the south of the Eiger.

Here the traveler will command a grand panorama—the lower saddle of the Mönch, the Bergli, the Walcherhorn, the Grindelwald Fiescherhörner, and the Finster-Aarhorn.

Beyond Eismeer the line takes a westerly direction; and there is a stiff gradient here up to the next station, Jungfraujoch (11,090 feet).

Still mounting, the line eventually reaches the terminus station, Jungfrau (13,428 feet). Hence the passenger may ascend to the summit of the great mountain, with her dazzling shroud of eternal snow, either by a lift 242 feet high, or by a winding staircase on the outside.

The total length of the line will be 7¾ miles.

The first section (Scheidegg to Eiger Glacier) was opened to traffic on September 19, 1898; the second section (Eiger Glacier to Rothstock) on April 2, 1899, and the third (Rothstock to Eigerwand) was opened during this last summer.

The average gradient is 17 per cent, the maximum being 25 per cent. The gage of the track is 39 inches; the weight of the rails is 42 pounds per yard and these are bonded and cross-bonded. The sleepers are of steel, of the usual Continental type, and the rails are fixed by means of bolts and clamps.

The rack system employed is that invented by M. Emil Strub, author of "Les Chemins de Fer Funiculaires Suisses."

A rail of the ordinary Vignoles type is employed, the teeth being cut in its head, which is made higher than is usual in such constructions.

The rack rails are made of soft steel, which is rolled solid, the teeth being cut afterward in the cold bar.

The curve of minimum radius is 100 meters.

THE POWER STATION.

The motive power for working the line is derived from waterfalls on the White Lütschine, which furnish 2,650 horse power.

The power house, some 6 miles from the railway, contains three sets of turbines:

1. Two Girard turbines of 500 horse power each, supplied by Ruter & Co., of Winterthur.

2. Two Francis turbines of 800 horse power each, supplied by Escher, Wyss & Co., of Zurich.

3. Two subsidiary turbines of 25 horse power each, from Ruter & Co., of Winterthur.

The turbines are directly coupled to three-phase alternators which generate at 7,000 volts.

There are at present two 500-horsepower alternators with a periodicity of 38 and making 380 revolutions, and one of 800 horse power. The supply conduit as well as the pressure conduit consists of pipes made of steel sheeting. The high-pressure current is transformed to current for the line supply at 500 volts in sub-stations, in each of which there are two 200-kilowatt Oerlikon transformers.

At the railway stations there are also 30-kilowatt transformers which transform the current to 200 volts direct for lighting and heating purposes.

The transmission line is carried on impregnated wooden poles, 100 feet apart, to the Eiger Glacier station, where it divides into two, one down the line and one up. The three copper wires are 7.5 millimeters in thickness.

Beyond the Rothstock station the high-tension current is placed within the tunnel.

The trolley lines, of which there are two, the rails being used for the return, are 9 millimeters diameter, carried on span wires 13 feet above the track, and are double insulated throughout.

ROLLING STOCK.

The rolling stock consists of electric locomotives, with Brown, Boveri, and Oerlikon motors. Each has two three-phase induction motors, in the former case of 150 horse power each and 760 revolutions per minute; the latter are 120 horse power, revolutions per minute 750, and periodicity 38 per second.

Trains are made up of a locomotive, a trailer coupled directly to it, and another trailer. Such a train weighs 28 tons and the rate of speed is 8.5 kilometers an hour on a gradient of 25 per cent.

The current is collected by four trolley poles, two for each phase. On each motor spindle there is a small six-pole direct-current generator giving 150 amperes at 25 volts, which forms an exciter for the three-phase motors in going down-hill, so that they become generators. The current thus produced is absorbed by resistances cooled by means of a small fan driven by a little induction motor.

A double belt brake can be applied by the tension of a strong spring upon the barrels resting on the axles of the motors.

The locomotive is incased in an inclosure with windows and doors. The first carriage is coupled on to the engine; its front rests upon a bogie, while the rear part is suspended by springs from the frame of the locomotive. The conductor's place is in front in an inclosed compartment. A complete train holds 80 passengers.

INFLUENCE OF HIGH ALTITUDES ON PASSENGERS.

The promoters of the Jungfrau Railway have not forgotten to take into consideration the important question of the influence of the high altitudes on the health of the traveler of this great mountain line. Mountain sickness is a most disagreeable complaint from which many mountaineers suffer, and one might reasonably expect that an ascent to a height of over 13,000 feet would seriously inconvenience those who attempted it, by reason of the diminution of atmospheric pressure and the breathing of the rarefied air.

According to Capt. Spelterini, the well-known aeronaut, such fears are groundless. He has ascended in his balloon to over 12,000 feet with persons of various constitutions, and he mentions that never have they experienced any difficulty in breathing or any other disposition afterward.

He explains this by referring to the fact that a person carried up in a balloon remains stationary as far as his bodily functions are concerned, and that the heart is not required to do more work than under ordinary circumstances. We believe that a medical man will be in attendance at a certain height, to inform travelers whether they would be well advised or not in going on to the summit of the mountain.

The journey up to the top is calculated to occupy one hour and forty minutes, and thus the passengers will be able to more or less accustom themselves to the altered conditions. If they feel any ill effects from the rarefied air, they may rest for some time at the different stations and proceed on their journey by easy stages.

It may be stated that a short stay at an altitude of 13,000 feet has no weakening or unsettling effect upon the organism of a healthy person, provided this height be attained without any great bodily exertion.

The workmen are for the most part northern Italians, who live in a big building near the Eiger station. Each man has a separate sleeping place and there is a common room and infirmary; they have board and lodging free and are paid about four shillings a day, besides special money grants according to the rate of progress of the tunneling. Fresh bread is baked every day and there is also a smithy, carpenter's shop, and machine-tool shop. The resident officials are the engineers-in-chief, the electricians, the doctor, and the local secretary. All the necessaries of life, as well as the explosives and other materials required for the prosecution of the work, have to be taken up early in the winter, and the men live comfortably enough in their chilly winter quarters. From October to April the little colony is almost completely shut off from the lower world, the only visitor being a stalwart climber who arrives at occasions with letters, newspapers, etc. The list of the winter's stores includes such items as 20,000 pounds of flour, 6,000 pounds of frozen meat, and 4 000 pounds of potatoes; 25 tons of coal, 900 boxes of tobacco, and 50,000 cigars.

A word must be said as to the effect which the Jungfrau Railway will have on the beauties of the neighborhood. At first sight one might be tempted to say that the charm and glory of the Jungfrau range will have vanished forever when the line is built. But it must be borne in mind that for the greater part of the way the railway will run in tunnel and will thus remain invisible. The first portion of the line up to the Eiger Glacier is above ground, and of course the sight of overhead wires, trains, and hordes of tourists will annoy the man who goes to Switzerland in search of beauty, peace, and freedom from society.

But there are compensations. As has been pointed out, members of the Alpine Club will be enabled to reach the summit of the Eiger from the Eiger station in a comparatively short time. Similarly, being saved the exertions of a difficult ascent and starting from the Jungfrau in a southwesterly direction, they will have a much better chance for the grand glacier tour across the Aletsch Glacier out to the Eiggischhorn.

The Lebaudy Airship Record.

The Lebaudy airship made a record trip on November 12. In one hour and forty-one minutes it covered the forty-six miles between Moisson and the Champ de Mars, Paris. The average speed was about 27¼ miles an hour. The maximum altitude reached was 984 feet. M. Juchmes the aeronaut, who steered the balloon, had this to say about the trip:

"I left with Rey, my machinist, and one hundred and twenty kilogrammes of ballast. I did not take more, as the heavy rain had weighted the airship to the extent of ninety kilogrammes. The screws were turning at the rate of eight hundred revolutions per minute. We went in the direction of Saint-Martin-la-Garenne, Dennemont, Gassicourt and Mantes, entering the town from the western side, making the tour of the cathedral, passing over Limay and returning to the railway station of Mantes.

"At this point, the wind becoming stronger, at a height of two hundred and fifty meters, I increased the revolutions of the screw to one thousand a minute. I thus easily moved against the wind, and steered for the Chateau de Rosny. On arriving above the park I maneuvered the airship in every direction. It obeyed its helm perfectly. Then I steered for the balloon shed, at Moisson. The landing took place just before the door. The airship was put into the shed without any trouble.

"The journey may be summarized as follows: Start in the rain at a quarter to nine A. M.; route, Moisson, Lavracourt, Saint-Martin, Dennemont, Gassicourt, Mantes, Limay, Rosny, Guernes, Sandraucourt, Méricourt, Mousseaux and Moisson, landing at half-past ten A. M. Evolutions above Limay, Mantes and Rosny.

"Distance covered, thirty-seven kilometers; maximum altitude, three hundred meters. This altitude is explained by the drying of the balloon when the rain ceased. From this moment the ventilation worked without stopping to replace the escaping gas. We were acclaimed by the population all along our route."

Gordon McKay's Harvard Endowment.

The will of Gordon McKay, inventor of the McKay sewing machine, was recently filed for probate. By its terms Harvard University is made the chief legatee. The amount of the property left by Mr. McKay to Harvard at present amounts to $4,000,000, and will eventually surpass even that figure. After paying certain annuities, 80 per cent of the balance of the estate—the remaining 20 per cent being held as a reserve fund to cover any future possible deficiency in the annual income—will be invested by the trustees until such accumulations reach the sum of $1,000,000. The sums thus collected are then to be paid over to Harvard College. After this sum has been paid over, the will directs that 80 per cent of the income, after paying the existing annuities, shall be given annually to Harvard. The net income of the endowment will be used to promote science. The will states that special care should be taken that the "great subject of mechanical engineering in all its branches and in the most comprehensive sense be provided for." The salaries attached to the professorships are to be liberal, so that able scientific men will be attracted.

Necessity of Trade-Mark Registration in Japan.

News comes from Japan that the pirating of trade marks in that country has caused no little injury to the business interests of the merchants of California and the Pacific coast. The San Francisco agent of a large eastern manufacturing company is said to be authority for the statement that some of the most famous American trade marks have been appropriated and registered in Japan by dishonest Japanese pirates. The moral is obvious: American manufacturers should themselves register their marks in Japan.

Cody's Kite-Drawn Boat.

Mr. S. F. Cody, whose kites have been described in the columns of the SUPPLEMENT, succeeded in crossing the Channel from Calais to Dover in a collapsible boat drawn by a kite in thirteen hours. A similar attempt failed on October 10. The collapsible boat weighed four tons. A combination steering gear was used, which manipulated both kite and rudder.

Bridge Commissioner Lindenthal on November 10 awarded the contract for the steel superstructure for the new Blackwell's Island Bridge to the Pennsylvania Steel Company, whose bid was $5.132,985.

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Correspondence.

The Utility of the Scientific American.

To the Editor of the SCIENTIFIC AMERICAN:

In regard to the item in your issue for October 24, page 291, "Utility of SCIENTIFIC AMERICAN," you suggest the pasting of clippings on Manila paper. I am sorry you did not advise use of light muslin instead of Manila paper. The muslin renders clippings almost indestructible by ordinary use, while the Manila paper will soon break. D. N. BYERLEE.

Hood River, Oregon, October 27, 1903.

A Suggested Wing Arrangement for Flying Machines.

To the Editor of the SCIENTIFIC AMERICAN:

I have taken more or less interest in aerial navigation and the Langley experiments reported in the SCIENTIFIC AMERICAN; perhaps some suggestions of mine would interest your readers.

With regard to the wings of the Langley flying machine: Would not the stability be greater if the convex sides of the wings were down, and of larger area, to compensate for the difference, or even perfectly flat?

The principle (in this respect alone), as I take it, is that the air should spill from the wings which support the machine, to give stability. Kites fly better when their convex side is toward the wind, or when their surfaces are flat, than when the concave side is toward the resisting medium. In the latter case they are sure to dive and be unstable, for they cannot spill the air and adjust themselves to steadiness.

If the wings were made larger and slightly convex, or perfectly flat, on a flying machine, with the usual rudder vane adjustment, it would be much more under control. The small area must be facing the wind or the air, in the forward movement, and the larger away from it, or in trying to get there it will cause disaster, as the adjustment is too fine for even a man to control. A bird in soaring spills the air through its feathers in adjusting for its stability. This is controlled by the bird's instinctive and unconscious habit—the same as a man in walking never thinks of falling down. This fine adjustment is impossible in a flying machine without something else being relied on.

Another and a better idea is to have substituted for wings or part of the wing area, one or more revolving aeroplanes, circular and *concave side down.* These would be perfectly smooth and revolved rapidly *to keep them (and the machine) in one plane*, and to spill the air, get stability, and reduce the wing area, giving greater strength. If a clay pigeon ejected from a trap did not revolve, it would not soar so beautifully. It is kept in its one plane on the gyroscope principle. It remains rigid in that plane, and as long as its momentum is not exhausted, it continues to soar. Attach a motor to the clay pigeon, and it would soar (fly) until the motor stopped. Again, any lack of symmetry in the circular aeroplanes is compensated for by all its sides being presented constantly to the resisting air. If a clay pigeon were thrown from an arrangement which did not send it spinning, it would not soar, and if it did, perhaps for a time, it could not keep on, for it would not have a *special and fixed plane* which the revolving motion gives, and which a bird uses as its principle of keeping right side up.

A flying machine constructed on the clay pigeon principle, with motors to revolve sufficient-sized, slightly concaved aeroplanes, with the double-vane rudder controlled by a man, and, of course, the regular propellers for the forward thrust, would, I suggest, be much more stable and easily managed during flight than the concave wing arrangement.

Toronto, Canada ARTHUR E. HAGARTY.

The Cause of Hay Fever.

To the Editor of the SCIENTIFIC AMERICAN:

My attention has been called to an article published in a recent number of your valuable journal entitled "The Cause and Cure of Hay Fever." In the interest of science I wish to enter a very emphatic protest against the doctrine there set forth. In this article it is claimed that the disease in question is caused by a toxin, which is introduced into the system by the application of pollen to the mucous membrane of the eyes and nose; that the effects of this toxin can be counteracted by a serum procured in the usual way, and hence that the disease may be cured by its use. It is also stated that there has been until this time great uncertainty as to the cause of this disease, and that hitherto medical treatment has been of little use. I believe that all of these statements are very questionable. In the first place, all diseases which are caused by the introduction of bacteria into the system and the subsequent development of the toxins have certain characteristics in common. One is a prodromal or stage of incubation. This is absolutely necessary, as a certain amount of time is required for the development of the toxin after the introduction of the bacteria. There is no stage of incubation in hay fever. In other toxic diseases this varies from one day to three weeks. In hay fever the disease follows immediately upon the application of the irritant, and disappears as soon as this ceases. In toxic diseases the acute stage follows the stage of incubation, which is characterized by a considerable rise in temperature, indicating a serious constitutional disturbance. There is no rise in temperature in hay fever.

In toxic diseases the acute stage lasts for a variable time, ending in death or gradual recovery, as time is required for the system to eliminate the poison. Treatment by the antitoxin method does not cause an immediate disappearance of the disease. It only lessens its severity and duration. Hay fever disappears as soon as the application of the irritant ceases. Again, the irritant is not necessarily the pollen of flowers. Any kind of dust may cause an attack. Dust from horses which have not been properly groomed is a very frequent cause, and many patients cannot ride behind a horse at any time of year without having trouble. Even the contact of a probe armed with absorbent cotton sterilized will cause sneezing and irritation of the mucous membrane of the eyes and nose, and if this be continued will cause a genuine attack of hay fever. Flour dust affects many. Further, if the toxic principle alone is the cause of this disease, all would suffer, as every one is exposed continuously to the same influences during the summer season. A continuous exposure of people generally to the poisons of the other toxic diseases, such as diphtheria, smallpox, etc., would result very disastrously. All of this points indubitably to the fact that the irritant acts mechanically and not chemically or vitally. Again, all of the toxic diseases are either contagious or infectious. Hay fever is neither. Usually one attack of a toxic disease renders the patient immune from further attacks. Hay fever recurs year after year, and usually increases in severity. In toxic diseases a single inoculation of the poison is sufficient to produce all of its different phases, while the application of the irritant must be contagious in hay fever. It would seem clear, then, that the toxic theory is not tenable. The statements that there is great uncertainty as to the cause of this disease, and that hitherto the medical treatment has been of little use, are not true. The cause is perfectly understood, and the cure absolutely certain if the treatment be properly carried out. My experience during the past two years has fully demonstrated the truth of my claims, and I am absolutely certain that any case of hay fever or spasmodic asthma can be permanently cured. The fact that the so-called toxin will cause an attack of hay fever when applied to the nasal mucous membrane proves nothing, as the application of any irritating solution, such as nitrate of silver, will do the same thing. If the sensitive tissue in the nose be thoroughly deadened by applying cocaine, the paroxysm will cease. Such an application can have no possible effect upon a toxin. FLOYD S. MUCKEY, M.D.

Minneapolis, Minn.

Unconsidered Facts in the Art of Flying.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 31 you printed an article called "Unconsidered Facts in the Art of Flying." In this article there are points which the layman would misunderstand unless made clearer, and I would be pleased if you would publish this letter upon the subject.

In the first place, the conclusion is drawn that because birds often cover long distances in a short space of time, at the rate of 80 miles per hour, and because they are not powerful, that therefore the power to fly is much overrated. It is also claimed that it takes less power to travel in the air than on land. It is evident that the fallacy here comes from failing to recognize that it is the speed relative to the air, not the earth, which determines the power spent, and there is no evidence in existence, so far as I know, that any bird can travel at 80 miles per hour relative to the air. Suppose a bird has a cross section area of 8 square inches with a coefficient of resistance of one-half; then to travel at the rate of 80 miles per hour relative to the air would require the expenditure of at least 0.132 horse power, thus

$$\frac{80^2 \times .0035 \times 4 \times 117}{144 \qquad 550} = 0.132 \text{ horse power.}$$

This is a power which could not by any possibility exist in such a small bird. The logical conclusion is that a bird traveling at this speed relative to the earth is taking advantage of a strong *wind* going in his direction. Birds rise to heights to find such a wind, not to get in a rarer atmosphere.

The power necessary can be found by experiment; but this, while it means that this power is necessary for flight, does not mean that the bird itself must expend this power. A vulture can fly for hours in the air when we know that the power to do this cannot possibly reside in his muscles; he extracts it from the wind.

The conclusions in the above-quoted article are false, for they assume that since birds with a small amount of muscular power do fly, therefore but a small amount of power is *necessary* for *flight*. This is as absurd as to say that because there is no source of power in a sailboat, therefore it requires no power to drive a sailboat. As a matter of fact, it probably takes one hundred times more power to sustain a vulture in the air than the vulture exerts with his muscles. This extra power the bird extracts from the wind, by utilizing its variations.

To say that flight is accomplished with the expenditure of very little power by the bird is one thing; but to say that the phenomena of flight *require* the expenditure of but little power is similar to saying that it requires the expenditure of no power to drive a cable car because, forsooth, there is no motor in the car. The power to sustain any body in the air can be accurately figured; and to fly without that body expending that amount of energy simply means that the body must in some way extract the difference from the wind. If one is to depend entirely upon internal power, the internal power required is great; but if one is skillful enough to draw power from the wind, the internal power required may be reduced to any amount, depending entirely upon skill and local conditions. That there is a large source of power in the wind cannot be doubted since the publication of Prof. Langley's pamphlet on "The Internal Work of the Wind," which work is due to the fact that no wind is ever absolutely horizontal or uniform. Our dynamics of flight are perfectly sound, but our observations lead us astray, for we are never in a position to know exactly just how much power the bird is extracting from the wind.

The observation of birds will never tell us how much power is necessary for flight; from them all we can get is a knowledge of how much they extract from the wind, which of course is the difference between what they can exert, computed from the size of their muscles, and what we know is necessary for support, computed from the lift and drift of these birds, as found by experiment. The reason there is so much dispute over this question is because the ability to extract this power is entirely dependent upon local conditions, and local conditions vary for different observers. The power necessary for flight can be computed from experiments, but the question of how much of this power it is necessary to *carry with us* will depend upon our skill in guiding the machine and the local conditions. It takes much more power to travel in the air than on land, although that power need not reside in the thing traveling. It takes more power to travel in the water than on land, although in the case of the sailboat *no* power need reside in the boat.

The lesson to be learned is that skill is the first thing to be gained, for with this the amount of power that must be carried in the machine can be greatly reduced; but this does not in the least affect the fact that the phenomena of flight do require the expenditure of more power, regardless of the source from which it is drawn, than either travel in water or on land. A. A. MERRILL.

Boston, Mass., October 30, 1903.

The Current Supplement.

The current SUPPLEMENT, No. 1455, contains a variety of instructive articles. Among these may be mentioned the front-page article on the Tunis gas plant, illustrated by two clear engravings; Major Baden-Powell's *resumé* of recent aeronautical progress and deductions to be drawn therefrom regarding the future of aerial navigation; and the continuation of Mr. George J. Henry, Jr.'s paper on tangential water-wheel efficiencies, admirably illustrated with instantaneous photographs of the effect of a stream of water on Pelton buckets. Prof. Meldola's paper on the relations between scientific research and chemical industry is concluded. Dr. S. G. Tracy tells of the use of radium in medicine. Dr. Horace C. Hovey presents a very fully illustrated account of the Colossal Cavern of Kentucky. Mr. A. Frederick Collins describes the camphor industry of Formosa—a counterpart to the article on artificial camphor appearing elsewhere in this issue. A hydraulic coal hoist for discharging coal from railway cars directly into a ship's hold is described and illustrated.

Height of the Sea Breeze.

Observations as to the height of the diurnal sea breeze are few in number, albeit of considerable importance. By means of a captive balloon, sent up from Coney Island a number of years ago, it was found that the average height at which the cool inflow from the ocean was replaced by the upper warm outflow from the land was from 500 to 600 feet. At Toulon, in 1893, the height of the sea breeze was found to be about 1,300 feet, and a distinct off-shore current was found between 1,900 and 2,000 feet. More recently (1902), on the west coast of Scotland, Dines, using kites, has noted that the kites would not rise above 1,500 feet on sunny afternoons, when the on-shore breeze was blowing.—Quart. Journ. Roy. Met. Soc.

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SOME OF OUR COMMON SNAKES.—II.

BY ARTHUR RUSMISELLE MILLER SPAID.—PHOTOGRAPHS FROM NATURE BY THE AUTHOR.

(*Concluded from page* 353.)

Of the non-venomous snakes, the "racer" and "pilot" snake, indiscriminately called blacksnakes, are considered beneficial, especially the former, by a few agriculturists, on account of their well-known habits of destroying beetles and vermin, while their equally well-established habits, especially of the latter, of robbing birds' nests of eggs and young, places the ban on them with the majority of farmers. It is also claimed that blacksnakes will chase human beings, and even squeeze the life out of anyone so unfortunate as to be overtaken by one of these terrible serpents. The truth of the matter is, both do occasionally make a fine display of courage, provided they are facing a coward, although the racer usually turns tail and runs away more swiftly than any other ophidian can. The pilotsnake or mountain blacksnake is less likely to show fight, being rather clumsy, but it too knows how to frighten the timid. With its long body thrown into graceful curves and its mouth open, it does seem formidable to anyone who may not know its harmless disposition.

With a small dog whose fighting qualities consist principally of loud barking and a vigorous wagging of the tail, a large mountain blacksnake makes an interesting little fight. But the encounter is generally of short duration, for the moment the dog can be induced to pinch the snake a little, the clumsy reptile loses all courage and, like a coward, thinks of nothing but running away. It will be seen, therefore, that the blacksnakes are not only harmless, but cowardly as well. No one who has ever stood on a blacksnake's head and felt its tightening coils around his leg before cutting its head off with his pocket knife will be afraid of losing his life by its constrictions, the way people suppose the blacksnake makes its attack. The blacksnake is, nevertheless, strong, and in climbing a tree makes a fine display of its many muscles. The cartilage-tipped ribs are movably articulated to a great number of vertebræ, and by pushing them into the depressions of the trunk and crevices of the bark, and bending its body into short curves, the snake ascends the tree quickly without any apparent effort. To dislodge it is next to impossible without rough handling.

On one occasion I saw a racer, the only true blacksnake, go up the body of an ironwood and glide swiftly through its branches, which hung over a small stream. I have observed others lying on the fence or on bushes, either looking for prey or taking a sunbath. While setting up my camera in front of a chickadee's nest, I discovered by mere accident a blacksnake lying on a branch of a white pine top a few feet away, either enjoying a sunbath or watching for the chickadees, the parent birds frequently alighting in the old pine top on their way to and from the nest. At another time I witnessed a pair of catbirds making a bold defense against a blacksnake bent on devouring the contents of their nest. At first the snake was inclined to disregard the distressed birds as they fought to drive it away, but the blows of their wings and bills became so annoying that the thief had to seek refuge in flight. On reaching the roots of a tree from which the river had washed the dirt, the snake started to climb, only to be driven beneath them, and then out to an old stump, under which the baffled and beaten reptile took refuge. In coming down a tree these arboreal serpents make the same careful selection of every point of vantage in the unevenness of the bark as when ascending.

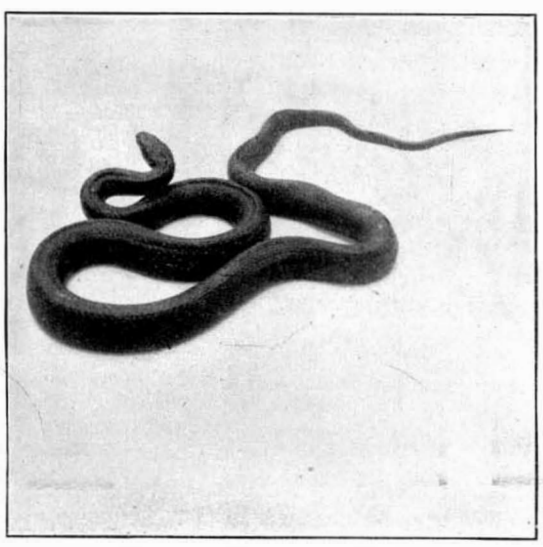
Other snakes climb, too. Rattlesnakes and copperheads crawl upon fences to watch for their prey. The greensnake spends a great deal of time among the branches of low bushes, gliding among them as rapidly as a snake on the ground. The milksnake or housesnake has a reputation for climbing about buildings, and may be found in the barn, granary, cellar, or house. A friend of mine found one nicely coiled on the mantelpiece of his sitting room last summer. They mean no harm by their familiarity. In fact, they belong to the class of beneficial reptiles, and catch as many mice as the blacksnakes, if not more; but like them they will occasionally rob a bird's nest. Their ability to climb is marvelous. They can easily crawl around on the rim of a flour barrel, or turn around on a walking stick held out horizontally. I had a specimen that could crawl from one object to another over the varnished surface of a walking stick whose diameter was smaller than that of the snake. The housesnake when discovered on the ground frequently assumes an attitude of attack. Throwing its body into a few curves, it draws back its head in a threatening manner, vibrating its tail just as nearly all of our snakes do under such circumstances. Its efforts to strike, however, are feeble, and its slender head proves to the observer at a glance that the reptile is harmless.

The copperhead and rattlesnake bring forth their young alive, eight or nine in number. The gartersnake also produces a large number of young, while the most of our common snakes lay eggs, from which the young hatch in due time.

Snakes have no eyelids, but their eyes are protected by the transparent skin which covers them. When the time for exuviation arrives, the skin which covers the eye like the crystal of a watch comes off with the rest. But for some days before this interesting process takes place, the eye has a bluish white appearance, and some persons claim that the snake is blind. This, however, is not true. The snake can see, but it evidently looks through a "glass darkly" until the old skin comes off, revealing the clear eye beneath. While the sight is thus impaired, the snake is very irritable.

Although the copperhead and rattlesnake are well known in many localities, they are perhaps too rare to be classed with our common snakes, yet this article would not be complete without giving them a passing word. The venom of the copperhead is not so fatal as that of the rattlesnake, the bite of the latter being fatal in many instances. The rattlesnake grows to be five or six feet in length, while a copperhead over three feet long is considered large. Like the rattlesnake, it seems to be most active during the night, lying coiled up during the day. The "snake tracks" made across dusty roads during the night are in many instances those of the pit vipers. In the evening, when they come from their hiding places, they are very active. The copperhead has a horny tip on its tail, the top of the head is a bright copper color, and its tongue is reddish, while the tongues of other snakes are black. The neck is slender, and the head is triangular. It has a very irritable disposition. The rattlesnake is easily distinguished by the rattle, whose warning sound has saved many a person from imminent danger. The rattle does not indicate, as is popularly supposed, the age of the snake, for instead of the rings or sections numbering the years, they show only the number of times the snake has shed its skin, which may be as many as four in one year. The snake holds the rattle in a position to sound a warning, which in some cases is outside of the coil. Fortunately for man and beast, our two representatives of the pit vipers are not aggressive in their attacks, and are not able to strike more than one-third the length of their bodies.

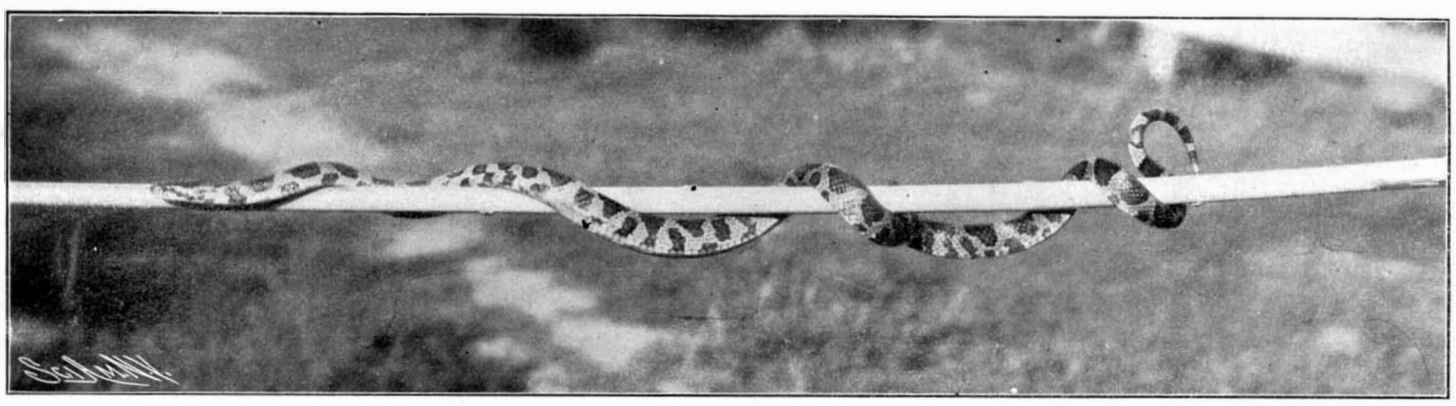
Blacksnake 5 Feet Long Climbing a Locust Tree.



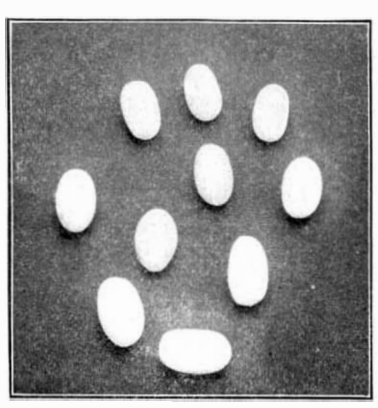
A Mountain Blacksnake Ready to Fight.

A Banded Rattlesnake Coiled to Strike.

A 5-Foot Mountain Blacksnake Fighting a Dog.



A Milksnake Crawling Along a Cane.



Eggs of the Mountain Blacksnake.

SOME OF OUR COMMON SNAKES.

A Cretan Museum.

Dr. Arthur Evans has ceased, for the time, his great labors in Crete, whereby he is entirely reconstructing what is, to us westerns, the most important epoch in history. The question has been asked, Where are his treasures to be stored? and many who saw his exhibition at Burlington House last winter have hoped that some of them might find their way, considering Dr. Evans's nationality, to the British Museum. It is now reported from Munich, however, that the foundation stone of a Cretan museum has been laid in Candia, wherein there will be stored all the priceless antiquities which have already rewarded Dr. Evans for his spadework in Knossos. Remembering the shame of the Elgin marbles, we can only say that this is well. Crete, to which we owe a debt that is as yet inestimable, is surely entitled to the possession of those great beginnings of fine art and those significant clay tablets with which she initiated European history three thousand five hundred years ago.

One thousand rare plants from Mexico that will constitute a part of the Mexican exhibit at the World's Fair are *en route*. They will be placed in hothouses and transplanted in the gardens around the Mexican pavilion next spring.

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THE TALAMANCANS—A FORGOTTEN PEOPLE OF PANAMA.

BY C. D. HAYWARD.

Within less than one hundred miles of where the United States intends to complete the greatest inter-oceanic ditch the world has seen, in territory where the newly-created republic of Panama is situated, there dwells an Indian nation that is to all intents and purposes identically the same to-day as it was when Columbus first discovered the western hemisphere. These are the Talamancans, who inhabit a few square miles in the mountains almost midway between the two oceans and but a comparatively short distance from the Panama Railroad, though it is much to be doubted if they have ever seen it or are aware of its existence.

For upward of four centuries the medieval civilization of Spain has surrounded them on all sides, but they have neither been contaminated by its influence nor exterminated by its kindness, as was the case in Cuba and other Spanish colonies. Their language is still their own, and seems to have lost little of its original character through contact with the execrable mixture of English, Spanish, and French spoken by the lower classes throughout the West Indies and along the Spanish Main. Living in virtually an unknown region, at least three days' journey from the nearest settlement, their solitude is seldom broken. The visitor is received with the greatest hospitality, and is welcome as long as he desires to remain. Their visits to the outer world are infrequent, rarely extending beyond the nearest port, and are undertaken only in quest of luxuries. Extra fowls and porkers are bartered on these occasions for tobacco, gewgaws, and ammunition. The spear and blowgun are used more than firearms for various reasons. The former are not only infinitely cheaper, but usually more effective in the hands of the Indian than the cheap muzzle-loading fowling piece of French or German origin with its paper-like barrel—the only arm he can afford to purchase besides the machete.

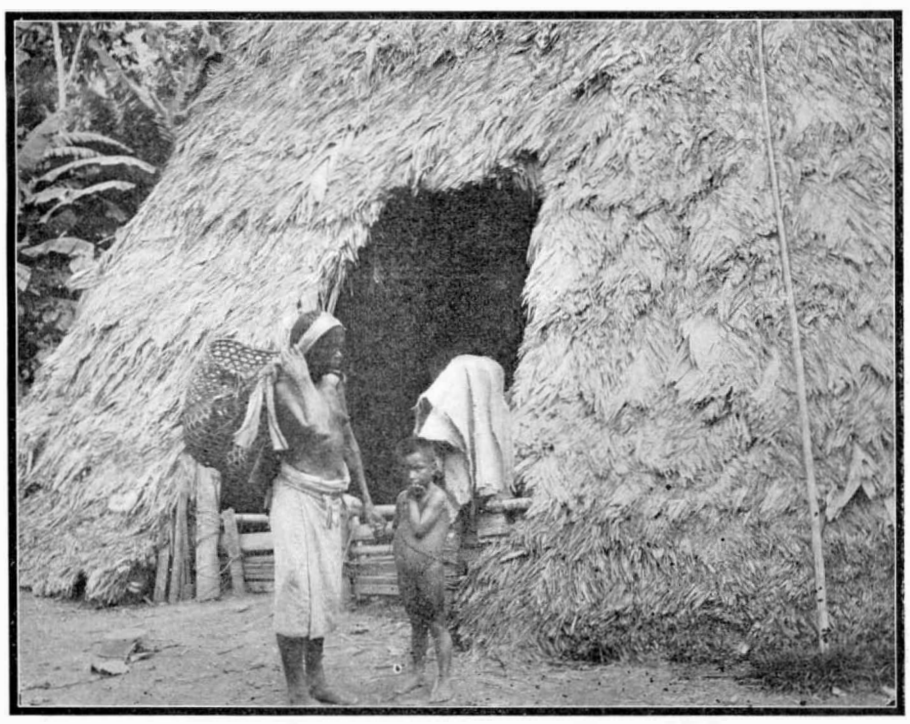
Their language and customs in some respects resemble those of the score or more of widely differing peoples that are scattered over the territory lying between the Mexican border and the Isthmus. Their ancestors doubtless served Aztec masters for centuries before Cortez appeared on the scene to impose a worse slavery upon them, for they are not of the superior race of which so many reminders in the shape of gold and silver ornaments, stone idols, and curious specimens of pottery have been unearthed in quantities in several of the Central American States, and being the opposite of warlike, they could easily be held in bondage.

They are not idolaters in any sense of the word, nor do they profess religion or hold public worship of any nature, though their belief tends more to fear of an evil spirit than faith in a good one; in fact, the Talamancans present an instance of a nation without doctor, lawyer, or priest, the "sokee," corresponding to the medicine man of the North American tribes, usually combining the functions of all three. Polygamy is the most important feature of their domestic relations, few if any of the members of the different tribes being content with less than three to half a dozen wives, while his Talamancan Majesty might well exclaim with Launcelot, "Alas! Fifteen wives is nothinge." His seraglio is usually better provided in point of numbers.

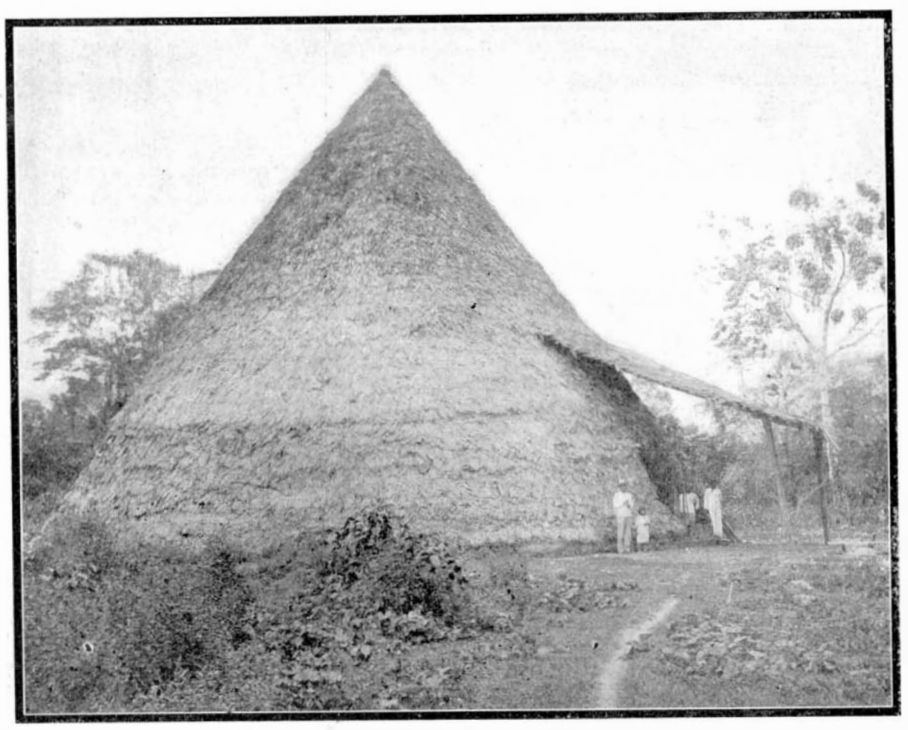
King of the Talamancans in Full Regalia and a Visitor.

The government of this Indian nation is entirely hereditary, and it is astonishing to learn of the many points of the doctrine of primogeniture as practised by the reigning families of Europe, with which they are familiar. Their laws are naturally few in number, both the legislative and judicial power, as is usually the case where no fixed principles of either have been acquired, being vested exclusively in the king. In common with others in his position the world over, he is a despot, and rules according to royal whim where this does not conflict with long-established custom. The marital relation is held sacred. The engagement of a girl begins within a few hours of her birth, the bridegroom-to-be making a contract with the parents at that time. It is usually consummated when she reaches the age of ten or twelve, a custom that is responsible for great disparity in the age and longevity of the sexes.

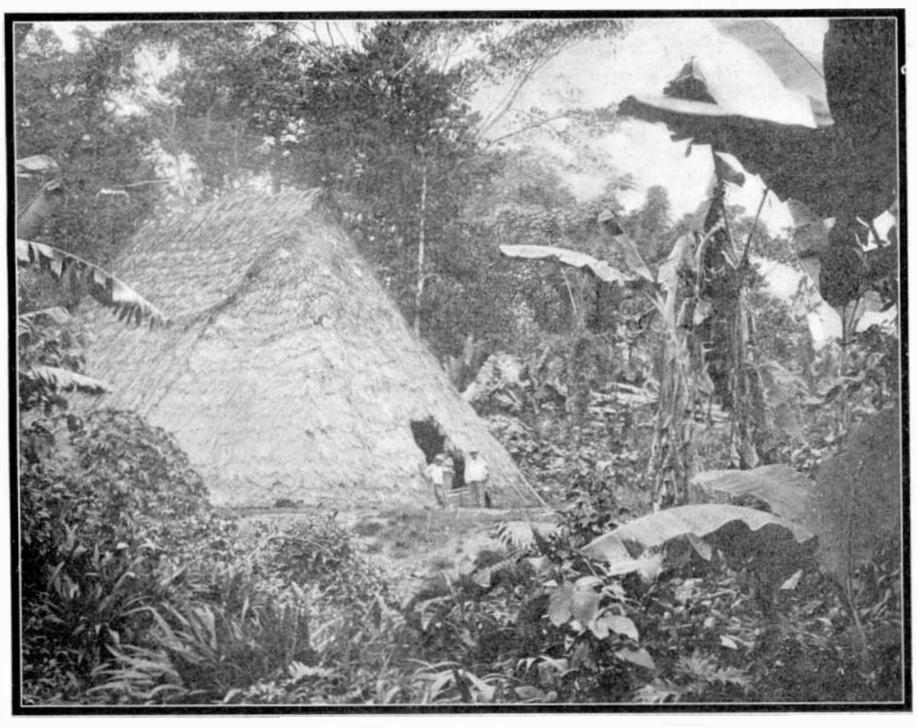
The needs of the Talamancan are primitive to a degree characteristic of the early ages of man, and as nature provides for him with a bounteous hand, his is an existence of dreamy contentment undisturbed by thought of the morrow or fear of the hereafter, for the missionary has never penetrated to his forest home. The rivers teem with many varieties of edible fish, and game abounds to a degree unknown outside the tropics, while the soil is so fertile as to give rise to the saying that it will raise pickaninnies. A little corn and cassava are planted, and the soil and climate do the rest; when they mature, which in the case of corn is four times a year, they are prepared in the same manner as that practised by



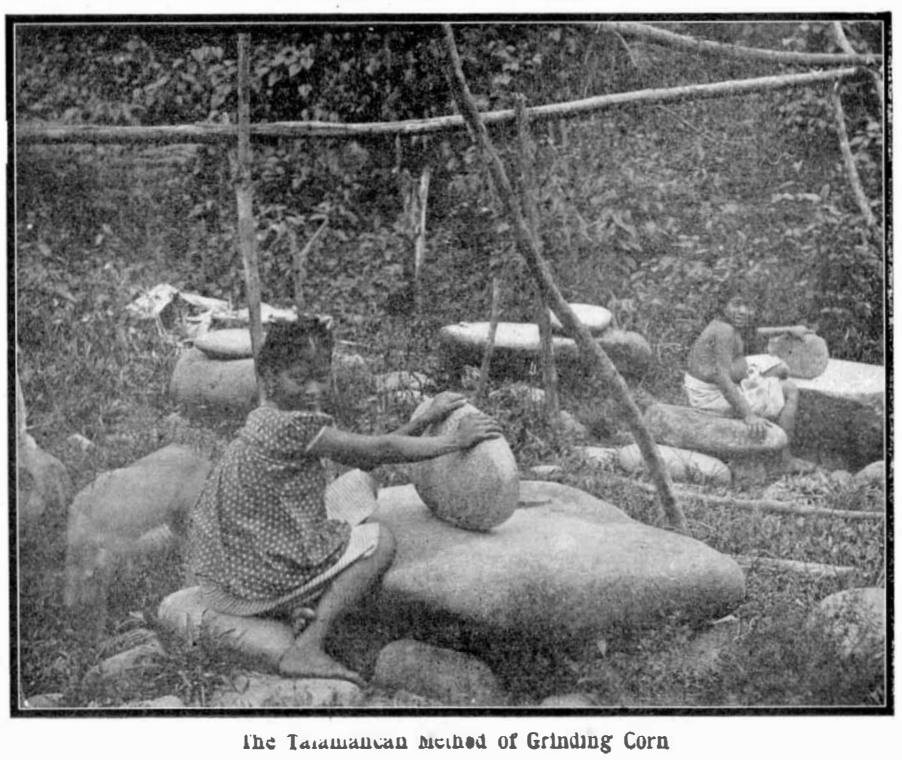
A Talamancan Mother and Child.



The Talamancan Royal Palace.



Plantains and Pineapples Growing Near the Huts.



The Talamancan Method of Grinding Corn

THE TALAMANCANS—A FORGOTTEN PEOPLE OF THE NEWLY-CREATED REPUBLIC OF PANAMA.

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their forefathers from time out of mind. Clothing, whether for man or woman, is of the scantiest description imaginable except on gala occasions or a visit to the settlement, when the trousers and shirt of civilization are donned by the former, the children running about absolutely naked until several years old.

The Talamancan's hut, which is a masterpiece in the art of thatching, is a huge affair, and shelters his entire family and all his worldly possessions, including the domestic animals, that continually root around the interior during the day and retire with him at night. As he is a past master in the art of domesticating the wild deer, the peccary, the tapir, and even the tiger cat, numbers of these animals are present in every village, taking the place of the motley pack of mongrels that usually greet the visitor at such humble settlements. His bed consists of the trunk of a certain species of palm, cut into strips and supported three or four feet from the ground on a frame, and a few earthen pots with now and again an iron one complete the furnishing of his house.

While adept with the spear and deadly blowgun, in which various of the South American tribes employ poisoned darts, he is of the most peaceable nature, and his traditions contain no stirring tales of conquest, nor does his conversation boast of personal valor, for he knows not war. In short, the Talamancan is forever at peace with all the world, and only desires to pursue the even tenor of his way unmolested to the end of the chapter.

Dedication of the Germanic Museum at Harvard.

The Germanic Museum at Harvard University was dedicated November 10. Valuable gifts from Emperor William II. were presented formally and accepted by President Eliot on behalf of the University, by Prof. Francke for the Museum, and by Carl Schurz for the Germanic Museum Association. Baron von Busssche-Hadenhausen, First Secretary of the German Embassy, in presenting the gifts of Emperor William said:

"The Emperor sent to Harvard University a collection of reproductions of typical German sculptural monuments, from the eleventh to the eighteenth century, hoping that they will kindle and encourage the interest in the United States for the sculpture of our ancestors, who, to a great extent, are your ancestors as well.

"I am happy to couple with this formal presentation of the Emperor's gift the announcement of two other gifts which are about to be made to Harvard University. A year ago last April, after the friendly reception of his Royal Highness, Prince Henry of Prussia, by the people of the United States, there was formed in Berlin a committee of leading men of science, art, literature, and finance, with the view of supplementing the Emperor's donation by a gift from the German people. The committee decided upon a collection of galvano-plastic reproductions of representative works of German gold and silver work, from the fifteenth to the end of the eighteenth century. This collection, consisting of over thirty large and some twenty smaller pieces, all of them specimens of the best workmanship of three centuries, is now nearly completed, and I have been authorized on this day to state that by the end of the year this gift of the German people will be in the possession of Harvard University. It is most gratifying that still another side of German life is to be represented by a gift which comes from your own midst. I refer to the donation of ten thousand books on the history of Germany and of German civilization which Prof. Archibald Cary Coolidge is to make to Harvard College as a memorial of the visit of Prince Henry of Prussia to the University in 1902."

President Eliot responded in behalf of the University. He referred to "the generous and suggestive act of his Majesty, the German Emperor," and said: "That act was unique in the history of this university, and, indeed, in the history of education."

Panama and Its Commerce.

The commerce of Panama amounts to about 3 million dollars per annum, its population to about 300 thousand, and its area to 31,571 square miles, or nearly equal to that of the State of Indiana. These figures are supplied by the Department of Commerce and Labor through its Bureau of Statistics, and are the latest available data on commerce, population, and area. Those of commerce are from the reports of the United States consuls at Panama and Colon, which have just been received, and not yet published; those of population are based upon the latest official estimate, which shows the population in 1881, and was based upon the census of 1871; while the figures of area are from accepted geographical authorities and are those of the area of the "Department of Panama" of the Colombian Republic. The principal ports are Panama, on the Pacific coast, and Colon, on the Atlantic side, and these ports are visited annually by more than one thousand vessels, which land over one million tons of merchandise and nearly 100,000 passengers, chiefly for transfer over the Panama Railway, 47 miles in length, connecting the Pacific port of Panama with the Atlantic port of Colon.

Colon, or Aspinwall, as it is sometimes called, has a population of about 3,000 persons. The city of Panama has a population of about 25,000. It was founded in 1519, burned in 1671, and rebuilt in 1673, while Colon is of much more recent date, having been founded in 1855.

The population, which, as already indicated, amounts in number to about 300,000, is composed of various elements—Spanish, Indian, negro, and a limited number of persons from European countries and the United States, especially those engaged in commerce and transportation and the operation of the Panama Railway. A considerable number of the population is composed of persons brought to the isthmus as laborers for the construction of the canal, and of their descendants. Since the abolition of slavery in Jamaica a considerable number of blacks and mulattoes have settled on the isthmus as small dealers and farmers, and in some villages on the Atlantic side they are said to be in the majority, and as a result the English language is much in use, especially on the Atlantic side. Some of the native population have retained their customs, speech, and physical type, especially those in the western part of the province, and claim to be descendants of the natives found there by the Spaniards when they discovered and conquered the country.

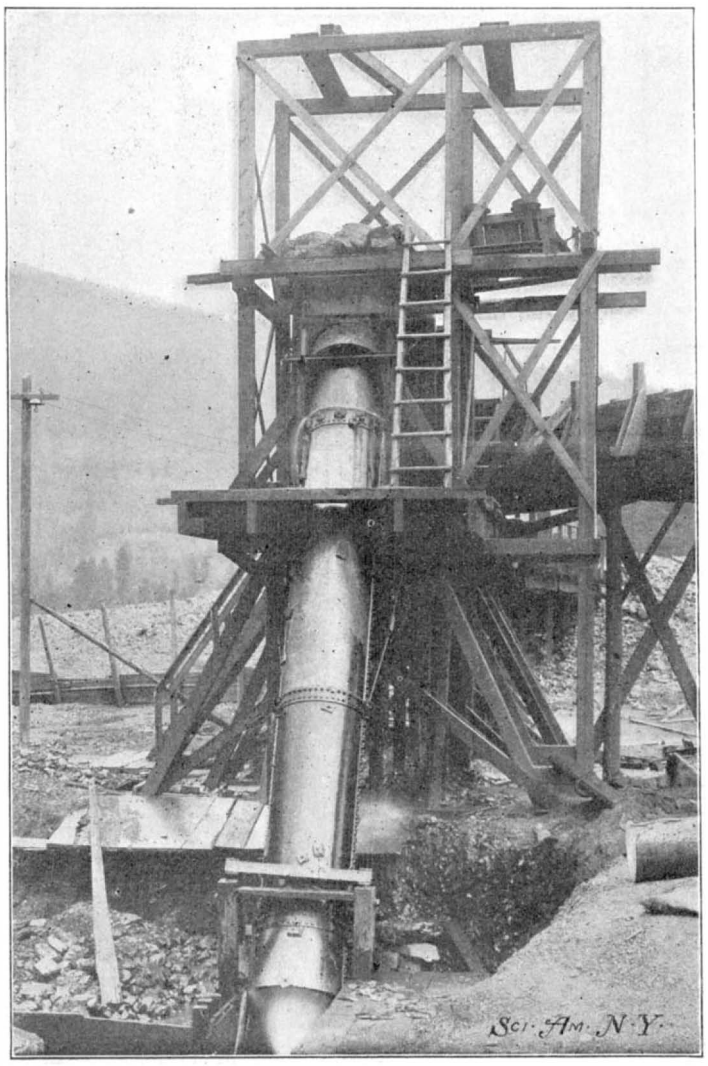
Of the commerce of Panama, the United States supplies a larger share than any other country. The importations at the port of Colon during the fiscal year ended June 30, 1903, as shown by the report of the United States consul, amounted to $952,684, of which $614,179 were from the United States, $119,086 from France, $118,322 from England, $76,386 from Germany. The figures of the fiscal year 1903 show a considerable increase from those of 1902, in which the value of the imports at Colon was $776,345. Of the $614,179 imports from the United States at Colon in 1903, $200,744 were dry goods, $189,333 provisions, $59,890 coal, $38,642 lumber, $32,900 kerosene, $30,400 liquors, and $31,940 hardware. The value of the importations from the United States in 1903 exceeded those of 1902 by about $160,000. The exports to the United States from Colon in 1903 amounted to $173,370, of which $75,432 were bananas, $54,960 cocoanuts, $12,472 turtle shells, $9,400 ivory nuts, $6,460 hides, and $5,924 coffee.

From the port of Panama the exports to the United States in the fiscal year 1903 amounted to $193,342, of which $56,767 were hides, $49,974 India rubber, $27,805 cocobolo nuts, $16,598 ivory nuts, $13,372 deerskins, and $6,908 coffee. The consul at Panama states that the imported articles come mostly from England, Germany, France, Italy, and the United States, but gives no statistics of the imports.

Panama is connected with San Francisco by a weekly steamer schedule operated by the Pacific Mail Steamship Company, and with Valparaiso by a weekly steamer schedule operated by the Pacific Steam Navigation Company and South American Steamship Company. Two passenger and two freight trains leave Panama daily for Colon, and Colon daily for Panama. The time for passenger trains over the 47 miles of railway is three hours.

From Panama there is one cable line north to American ports, and one to the south. The actual time consumed in communicating with the United States and receiving an answer is stated by the consul to be usually about four hours. There also are cable lines from Colon to the United States and Europe.

The money of the country is silver, the rate of exchange having averaged during the past year about 150 per cent.



AN HYDRAULIC PLACER ELEVATOR.

HYDRAULIC ELEVATORS FOR HOISTING PLACER TAILINGS.

BY DENNIS H. STOVALL.

The hydraulic elevator has become a necessity in many of the placer mines of the West, in order to make room for the mountains of bowlders, rock, and debris that are removed in the process of surface mining. After thirty or forty years of constant work, the diggings of many of the mines have narrowed down, and now confine themselves to the more remote slopes and gulches, which, a few years ago, could not have been worked by the methods then known. When the hydraulic giant was first introduced in the western placer fields, the mines that used them had to have efficient dumping grounds, or "dump," as the miners express it. This meant that there had to be a sheer drop of 30 or 50 feet at least from the end of the sluices, down into the gulch, cañon, or creek below, in order to give ample room for the tailings, or the rock and bowlders removed from the auriferous gravel banks.

There were many acres of rich ground on nearly every old channel that lay idle for many years, and could not be worked hydraulically for the reason that they did not afford "dump" enough. If giants were set to work on them, they soon found themselves blocked by the great heap of tailings, which could but be piled up on the bedrock, as the fall or drop in the sluices was not sufficient to carry them away. Consequently, operations were suspended, and such ground, though rich, lay idle for a number of years. Then some ingenious American invented, or rather discovered, the hydraulic elevator, and the question of caring for tailings where the "dump" was poor was solved for all time.

The form of elevator shown in the accompanying picture is the one most used in the placer fields of northern California and southern Oregon, and is giving entire satisfaction everywhere it has been introduced. It is a simple affair, and can be erected by any mining engineer of ordinary ability or intelligence. This form of elevator is only practical, however, where there is an ample water supply, and where the gravity pressure is at least 275 feet, and under such conditions it is capable of lifting any bowlder of less than 800 pounds weight to a height of 35 or 40 feet, and send it hurling out through the sluices and over the dump.

This elevator consists simply of a 20 or 30-inch pipe set at an angle of 45 degrees over the end of the sluice or race that leads down from the bank being operated by the giants. The length of this pipe is the height to which the tailings can be raised. At the base of the pipe is a six-inch giant, planted in the ground in such a way as to throw its stream up through the pipe. Another giant is set midway of the pipe, and unites its stream with that of the one at the base. The rock and bowlders and dirt, together with the waste water that comes flowing down the bedrock sluice, are all caught by the giant's stream at the base of the pipe, and hurled up through and over the sluice-boxes at the top. In the upper sluice-boxes riffles are arranged, and here the gold settles and is caught, excepting the coarser pieces, which settle on the bedrock race before the elevator is reached.

The American Motorman of the 133-miles-an-hour Car.

A correspondent of ours informs us that the German car which recently made the record of 125 and 133 miles an hour was driven by an American, Charles A. Mudge, of Williamsport, Pa. Mr. Mudge is in the employ of one of the two large companies under whose direction the tests are being conducted.

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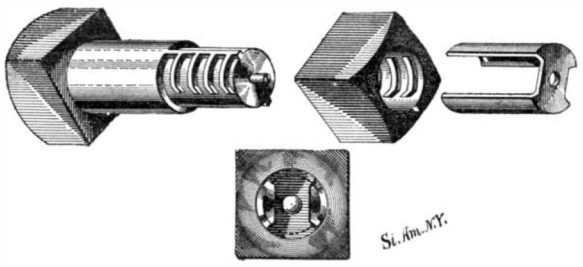
Patent Department

A NOVEL NUT-LOCK.

A bolt and nut which differ radically from the ordinary type are shown in the accompanying illustration. Instead of being threaded in the usual manner, the bolt and nut are provided with projections or ribs of



NEW TYPE OF NUT-LOCK.

such shape that the nut may be slipped on to the bolt without turning, and then tightly wedged in place by a quarter turn. The ribs as shown in the illustration are arranged parallel in groups or series on opposite sides of the bolt and nut, and extend over only a portion of their circumferences. When the nut is slipped on, its two series of ribs pass between the series of ribs on the bolt. It will be observed that the ends of the ribs on the bolt bend toward the right, and those on the nut have a bend in the other direction, so that when the nut has been forced home and given a turn to the right, the ribs will engage each other, and due to their bent form will wedge the nut tightly in place. When in this position a key-piece such as shown at the right in the illustration is slipped in between the nut and the shank of the bolt, so that its two parallel arms fit into the space on the bolt between the series of ribs, and prevent the ribs from turning out of their interlocked relation. A small pin projects from the end of the bolt. This passes through an opening in the end of the key-piece, and may be flattened or hammered to form a rivet-like head, thus holding the key in place. A patent for this invention has been obtained by Mr. Thomas McCabe, Jr., of 105 Fourth Avenue, Homestead, Pa.

IMPROVED PACKING RING.

The ordinary packing ring is dependent entirely upon its elasticity to so tightly engage the wall of a piston or valve cylinder as to resist lateral pressure of the steam. Obviously, any construction which would assist this elastic pressure of the packing material, and make its engagement with the cylinder wall more positive, would be an important and useful improvement. Such a construction may be seen in the accompanying illustration, and a patent for this invention has been granted to Mr. Thomas F. Meehan, 729 Quincy Street, Brooklyn, N. Y.

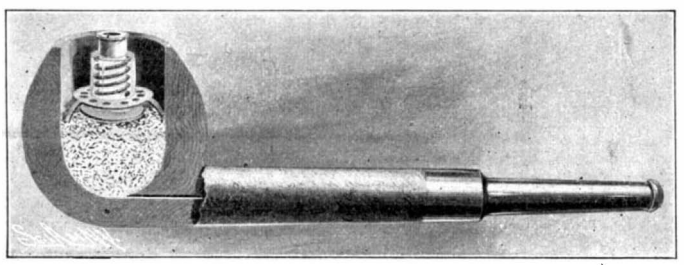
The improvement lies in the provision of annular flanges on the packing rings. These flanges are inclined, and form abutments for steam passing through inclined ports in the ends of the piston. In operation during the piston movement, steam will enter through these ports, and impinging upon the inclined fianges will force the rings out tightly against the cylinder. The rings are preferably used in pairs, one of which is provided with an annular groove or channel, into which an annular rib on the other ring fits. By means of this interlocking connection, the two rings are caused to move as one. In our illustration the figure at the left shows the improved packing ring as applied to a piston of the high-pressure type. It will be observed that the only change in the piston required for fitting on the improved packing ring, is to turn off the edge of the piston fiange and the follower ring to an angle corresponding with that of the packing-ring flange, and to bore the necessary steam ports. The figure at the right shows a piston of ordinary type fitted with a double packing, and also a piston valve similarly fitted. The small amount of work necessary on the piston, bull ring, and follower ring to adapt them to the improved form of packing ring will be apparent at a glance. The fact that the new type of packing ring can be so easily applied to an old piston is an important point in its favor.

Paper File and Index.

A new type of filing cabinet, which is operated by means of index keys, has recently been invented by Thomas J. Johnson, of Norman, Oklahoma Territory. The cabinet drawer is divided into compartments by wire partitions, which are connected with the index keys in such manner that on depression of one of the keys, the partitions of the corresponding compartment will be spread open to permit of readily filing a paper or removing it from the drawer. The papers are all filed on edge. When one compartment is opened, this operation closes the adjoining ones, and effectually prevents erroneous filing. The invention is particularly applicable to the filing of bank checks, a small file being used for distributing checks as these are paid, and a cabinet being provided for filing them away until the pass books are presented for a balance. The file will also be found very useful in many other ways. It is very compact, and requires comparatively little vault room. It may be easily manipulated; the operation is novel and catchy, and its time-saving advantages will be readily appreciated.

TOBACCO TAMPER AND COVER FOR TOBACCO PIPE.

A recent invention upon which a patent has been obtained by Mr. Joseph S. von Neida, of Sharon Hill, Pa., provides a simple device applicable to a tobacco pipe to prevent the tobacco from flying out of the pipe. It also comprises a movable part, which may be pressed downward with the finger to tamp the tobacco from time to time, so as to keep it burning. The construction of the device and its operation will be understood by a glance at the accompanying illustration. It consists of a perforated disk provided with outwardly-extending spring arms adapted to engage the side walls of the pipe bowl to hold the disk in position. Rising from the center of the disk is a cylinder, and in this a tube is mounted to slide. At the bottom of the tube the tamping disk is secured, and this is normally held in its upper position by a spiral spring in the cylinder which acts on the tube. By pressing down on the top of the tube the tamper disk will be forced down to compress the tobacco, or

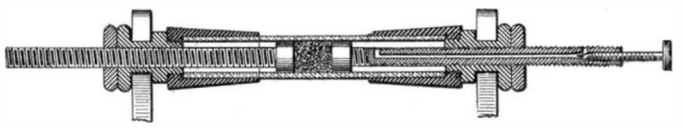


CONVENIENT PIPE-COVER AND TOBACCO TAMPER.

the whole device may be moved down slightly, accommodating itself to the decreasing amount of tobacco as it burns away. The principal advantages of this invention are the fact that the device is very compact and so small that it can be easily carried in the vest pocket, or preferably within the bowl of the pipe when the pipe is not being used, and also that it affords not only a cover to protect the tobacco while burning, but also a convenient means for pressing down the tobacco, which is usually accomplished by the bare finger of the one using the pipe.

AN IMPROVED CONSTRUCTION FOR COHERERS.

The coherer which is herewith illustrated does not differ in principle or operation from the ordinary instrument used in wireless telegraphy, but in its construction and general arrangement it offers a number of very important improvements. The construction may be described as follows: A glass tube is provided at the ends with hard-rubber caps cemented thereto. Contact terminals are threaded into these caps, and form bearings for the stems of the electrodes, which are screwed into the threaded bores of the contact terminals and secured by lock-nuts. The stem of one of the electrodes is provided with a central channel running longitudinally thereto, and opening at its inner end into the interior of the glass tube. At the outer end of the channel an opening is provided, through which air in the tube may be

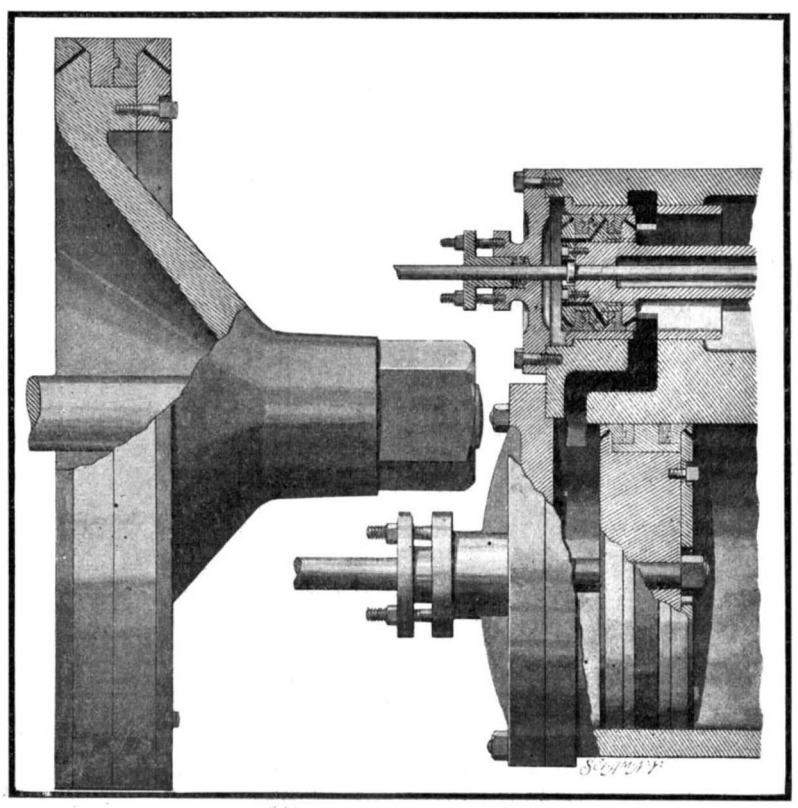


IMPROVED CONSTRUCTION FOR COHERERS.

pumped out to form the necessary vacuum. This opening may be closed by a needle valve screwed into the end of the stem. The contact terminals of the coherer are provided with flat sides, so as to be readily slipped into the contact jaws which form its support. The jaws at opposite ends of the coherer are insulated from each other, and are electrically connected with separate aerials. In operation the usual effect is produced, namely, the Hertzian waves cohere the filings between the electrodes, opening a path for the current of a local circuit which operates the telephone or telegraph. The filings are decohered by a tapper acting on the head of the needle-valve screw.

The principal advantages of the construction are that the air may be easily exhausted from the coherer and the coherer sealed, and that by means of the adjustable feature of the electrodes the coherer may be regulated according to tension and volume of the impulses. By reason of the contact jaws adapted to receive between them the contact terminals of the electrodes, a coherer may be readily slipped into these jaws to place it in circuit, and quickly and easily removed without detaching any of the conductors, thus making it possible to change the coherer while a signal is being received without losing any material part of the message. A patent upon this invention has been granted to Mr. Thomas E. Clark, of 67 to 71 Michigan Avenue, Detroit, Mich.

The United States Postal Department in considering the subject of formally indorsing the nickel-in-the-slot machine by adopting such a device for regular use in the forwarding of special letters. The invention is that of M. B. Mills, of Chicago, Ill., and it is meant to answer the demands of persons who desire to send a special delivery letter and who have not the necessary stamp and who do not want to go to the inconvenience of paying a visit to the post office. It is designed that the slot machines shall be placed in the hotels and public places in the business center of a city, and anyone desiring to make use of the machine has only to drop the coin in the slot, and this operation unlocks a door which permits the letter to be placed inside. As the door is closed the letter receives an impression which tells the number and location of the box and such other information as the postal authorities may have use for. Means are provided to prevent the perpetration of fraud, such as putting in two letters with one dime and depositing counterfeit coins or blanks similar to the coins in weight and shape. The coins fall into a receptacle in the order in which the letters are placed, and there will be no difficulty in determining which particular coin was deposited with each letter. In case two letters are inserted in the box when only one dime has been deposited, only one envelope will receive the impression. These boxes are about to be placed in the city of Washington, D. C., and their operation will be watched with interest by the postal authorities. If they seem to answer the purpose for which they are designed, they will be scattered around all the larger cities of the country.



A STEAM-PRESSED PACKING RING.

The shops of the Allis-Chalmers Company at West Allis, Wis., will be greatly enlarged to make provision for the manufacture of a new engine, making use of the gas generated in blast furnaces, the patent rights for which were recently acquired by the company. Edwin Reynolds, the consulting engineer of the company, says that the invention is a very important one, and while more room is required to turn out these new engines, there will be no need for new special machinery.

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RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ALARM FOR WATER-CONTAINING VESSELS.—J. O'CONNOR and C. A. TURNER, New York, N. Y. In this patent the invention relates to devices for giving an alarm when the water in a boiler or other vessel rises or falls beyond desired levels and also to control the inlet of water when this liquid becomes low, an object being to provide a device that shall be simple and compact in construction and positive in its action. The circuits of the bell or alarm device and the solenoid are in connection with a battery.

PRIMARY BATTERY.—J. A. PEDRAZZI, Carmel, Cal. This inventor's improvement is in the nature of a new primary battery designed for both closed and open circuit work and applicable for all the uses for which a galvanic battery is employed. It may be used for electroplating, telegraphy, telephones, fire-alarms, burglar-alarms, toys, bells, electric motors, for therapeutic and surgical uses, or for electric lights in places isolated from the wires of a power plant.

Engineering Improvements.

AUTOMATIC COUPLING FOR SECTIONAL PUMP-RODS.—T. COSTELLO, JR., and V. B. POST, Spencerville, Ohio. The inventors in this improvement have for an object the provision of a sectional pump-rod or other sectional shaft or rod with a simple novel coupling device for joining together the adjacent ends of the rod sections, which may be automatically connected by laterally pressing together the two complementary portions of the coupling device and may be readily disconnected without undue labor.

ROTARY ENGINE.—T. E. E. BARTLETT, Meridian, Miss. In Mr. Bartlett's patent the invention has reference to improvements in rotary engines; and the object that he has in view is to produce a simple, compact, and durable construction which is packed to reduce the leakage of the motive fluid and which is very efficient in operation.

ROTARY ENGINE.—R. L. BARNHART, Charleroi, Pa. This invention has particular application to a novel form of motor, designed to be driven by air, gas, steam, or similar expansive fluid, and is an improvement on a prior patent granted to Mr. Barnhart. The inventor forms the mechanism in two sections, an upper and a lower motor section, rigidly connected by a shaft, and connects the sections by a pipe or tube, and provides such sections with inlet and exhaust valves, the primary object being to obtain a maximum amount of pressure in each motor so that they will be driven in the same direction by the pressure being conducted from the upper to the lower motor-section, or vice versa. The parts are arranged to greatly muffle the sound of the operation of the engine.

BALANCED SLIDE-VALVE. — B. W. SCHENEBECK, Bolinger, La. The improvement comprises the combination with a pressure-plate and valve provided with an annular groove of an intermediate ring provided at opposite sides of its base with vertical side walls and having inwardly-sloping surfaces above the said side walls, and inner and outer split rings provided with sloping faces coinciding with those of the intermediate ring and arranged for operation thereby.

MARINE PROPELLER.—C. A. MANKER, Pearl, Ill. It is the aim of Mr. Manker's invention to provide an improvement in that class of propellers in which feathering blades are employed—that is to say, blades adapted to assume varying angles to the mobile fluid as they revolve. The propeller is primarily intended for use in marine propulsion, but it may be employed in aerial navigation under certain conditions.

Hardware.

COMPOUND TOOL.—J. F. WATERMOLEN, Greenbay, Wis. In carrying out this improvement the inventor has particularly in view as an object the formation of the main body portion or handle of the tool in such manner that the parts of the body portions may be easily and quickly assembled and to provide a simple, neat, and positively supporting or bearing frame for the tool-blades or tools proper.

WRENCH.—W. E. SEANOR, Hope, Idaho. The purpose in this invention is to provide a wrench in which the movable jaw can be expeditiously and conveniently adjusted upon the shank of the wrench to and from the fixed jaw and as conveniently and rapidly locked in adjustment position against all strain to which the movable jaw may be subjected.

Machines and Mechanical Devices.

MIXING DEVICE.—W. S. STANDISH, East Las Vegas, New Mex. In carrying out the present invention Mr. Standish has particularly in view the provision of means combined with the main portion of the apparatus for supporting and holding the weight of a cylinder or cask and the contents thereof, while at the same time permitting the use within the cask of a hollow shaft carrying beater-blades and a steam pipe used in the mill.

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Mechanics' Tools and materials. Net price catalogue. Geo. S. Comstock, Mechanicsburg, Pa.

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Sawmill machinery and outfits manufactured by the Lane Mfg. Co.. Box 13, Montpelier, Vt.

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American inventions negotiated in Europe, Felix Hamburger, Equitable Building, Berlin, Germany.

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Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

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Machine Work of every description. Jobbing and repairing. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 4799.—For machinery for extracting fiber from the cocoanut husk, also for manufacturing cocoanut oil.

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Inquiry No. 4805.—For manufacturers of electric welding machines.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 4806.—For makers of slot machines for drinking fountains.

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Inquiry No. 4812.—For makers of cigarette machinery for export.

NEW BOOKS, ETC.

THE COMPLETE LAW IN NATURE UNVEILED. By F. Warner Jones, C.E. London: Knowledge Office. 1903. 18mo. Pp. 32. Price 60 cents.

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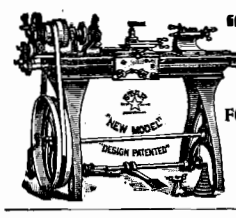
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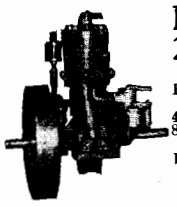
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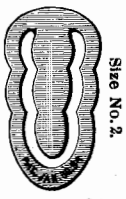
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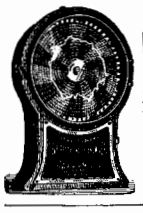
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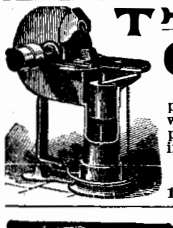
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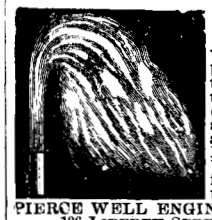
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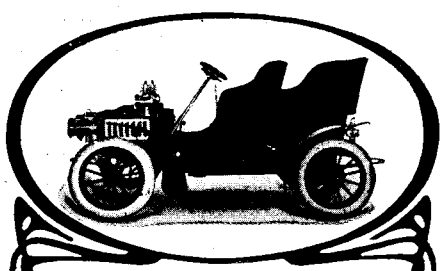

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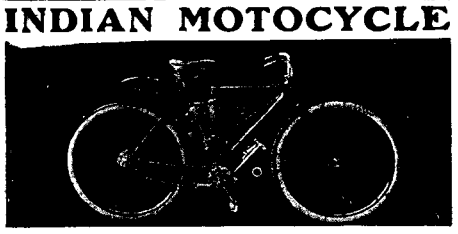

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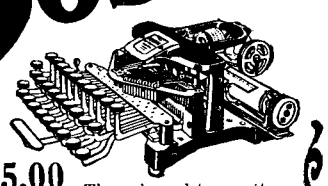

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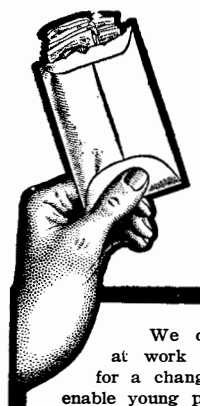

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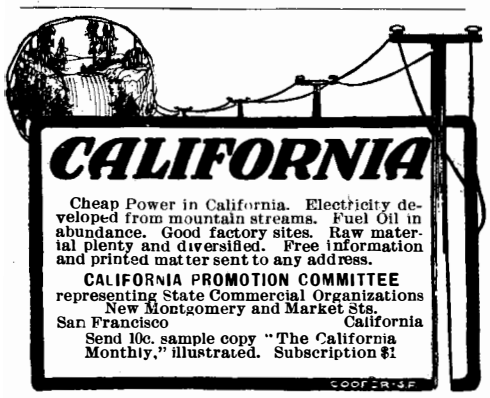

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Window, revolving metallic, L. Christenson	743,828
Window washing apparatus, S. C. Lawlor	744,013
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Work support, Nettles & Glenn	743,656
Wrench, R. H. A. Geistert	743,482
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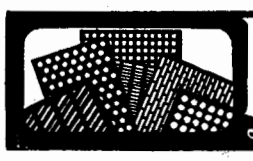

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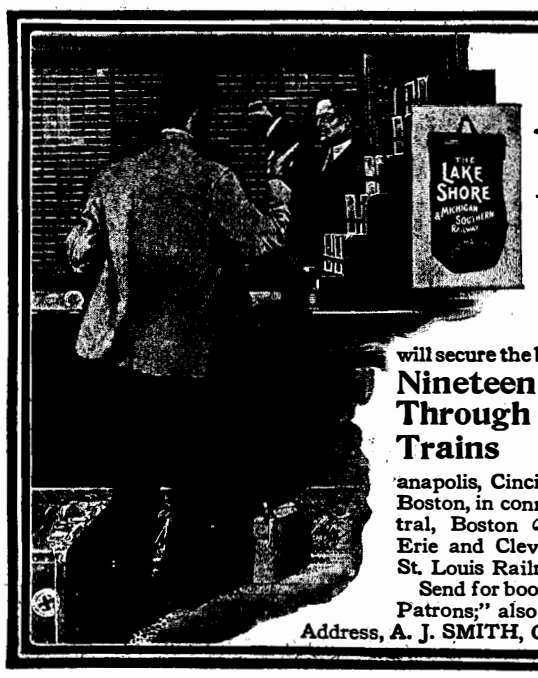

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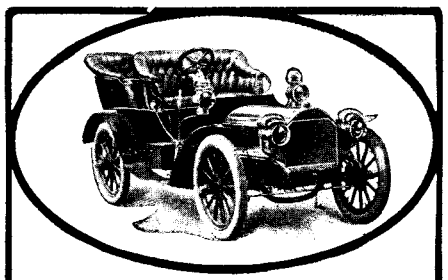

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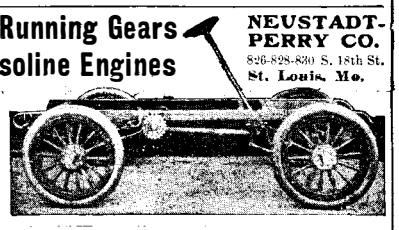

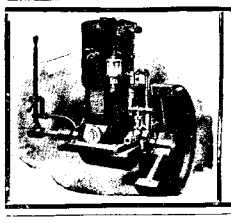

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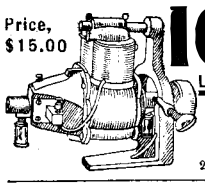

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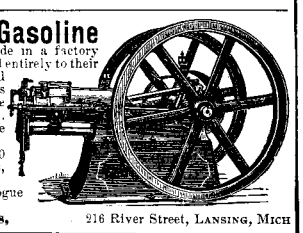

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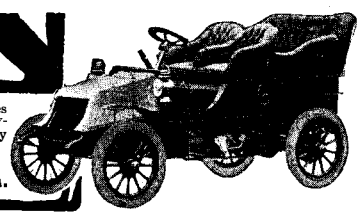

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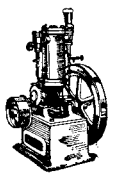

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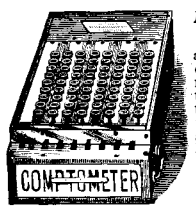

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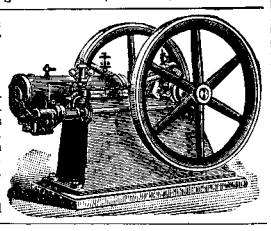

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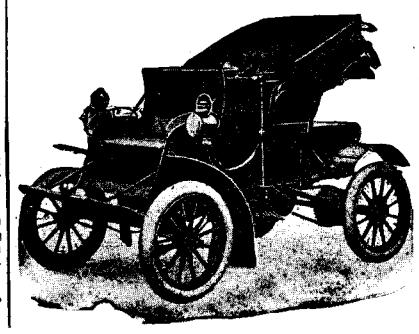

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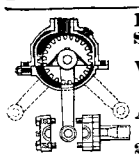

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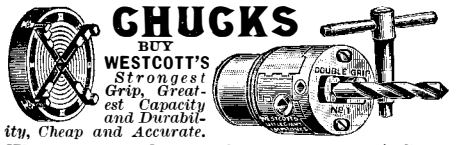

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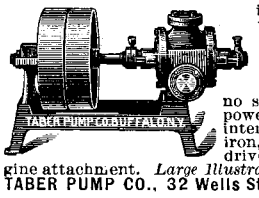

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